

## Manual Change

Agilent Part No. N/A

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### Change 1

Add TAR in Frequency Accuracy Test to the following.

Without Option 1D5

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR |
|-----------|---------------|-------------|---------------|-------------------------|-----|
| 100 MHz   | -550Hz        |             | 550Hz         | $\pm 2.47$ Hz           | 223 |

With Option 1D5

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR |
|-----------|---------------|-------------|---------------|-------------------------|-----|
| 100 MHz   | -13Hz         |             | 13Hz          | $\pm 2.0$ Hz            | 6.4 |

### Change 2

Add TAR in Source Level Accuracy / Flatness Test to the following.

Level Accuracy

| Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR  |
|---------------|-------------|---------------|-------------------------|------|
| - 1.0 dB      |             | 1.0 dB        | $\pm 0.12$ dB           | 9.42 |

Level Flatness

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-----------|---------------|-------------|---------------|-------------------------|-------|
| 10 Hz     | - 2.0 dB      |             | 2.0 dB        | $\pm 0.12$ dB           | 21.01 |
| 50 Hz     | - 2.0 dB      |             | 2.0 dB        | $\pm 0.12$ dB           | 21.02 |
| 500 Hz    | - 2.0 dB      |             | 2.0 dB        | $\pm 0.12$ dB           | 21.03 |
| 2 kHz     | - 2.0 dB      |             | 2.0 dB        | $\pm 0.12$ dB           | 21.01 |
| 12 kHz    | - 2.0 dB      |             | 2.0 dB        | $\pm 0.12$ dB           | 21.03 |
| 60 kHz    | - 2.0 dB      |             | 2.0 dB        | $\pm 0.12$ dB           | 21.03 |
| 160 kHz   | - 2.0 dB      |             | 2.0 dB        | $\pm 0.12$ dB           | 20.86 |
| 500 kHz   | - 2.0 dB      |             | 2.0 dB        | $\pm 0.13$ dB           | 19.4  |
| 1 MHz     | - 2.0 dB      |             | 2.0 dB        | $\pm 0.19$ dB           | 13.27 |
| 3 MHz     | - 2.0 dB      |             | 2.0 dB        | $\pm 0.19$ dB           | 13.27 |
| 10 MHz    | - 2.0 dB      |             | 2.0 dB        | $\pm 0.19$ dB           | 13.27 |
| 45 MHz    | - 2.0 dB      |             | 2.0 dB        | $\pm 0.20$ dB           | 13.26 |
| 75 MHz    | - 2.0 dB      |             | 2.0 dB        | $\pm 0.19$ dB           | 13.27 |
| 110 MHz   | - 2.0 dB      |             | 2.0 dB        | $\pm 0.19$ dB           | 13.28 |
| 140 MHz   | - 2.0 dB      |             | 2.0 dB        | $\pm 0.19$ dB           | 13.28 |
| 190 MHz   | - 2.0 dB      |             | 2.0 dB        | $\pm 0.19$ dB           | 13.28 |

|         |          |  |        |           |      |
|---------|----------|--|--------|-----------|------|
| 235 MHz | - 2.0 dB |  | 2.0 dB | ± 0.38 dB | 6.35 |
| 290 MHz | - 2.0 dB |  | 2.0 dB | ± 0.38 dB | 6.35 |
| 345 MHz | - 2.0 dB |  | 2.0 dB | ± 0.38 dB | 6.35 |
| 400 MHz | - 2.0 dB |  | 2.0 dB | ± 0.38 dB | 6.35 |
| 445 MHz | - 2.0 dB |  | 2.0 dB | ± 0.38 dB | 6.35 |
| 470 MHz | - 2.0 dB |  | 2.0 dB | ± 0.38 dB | 6.35 |
| 500 MHz | - 2.0 dB |  | 2.0 dB | ± 0.38 dB | 6.35 |

### Change 3

Add TAR in Non Sweep Power Linearity Test to the following.

| Power Setting | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR  |
|---------------|---------------|-------------|---------------|-------------------------|------|
| 15 dBm        | - 1.0 dB      |             | 1.0 dB        | ± 0.17 dB               | 6.58 |
| 10 dBm        | - 1.0 dB      |             | 1.0 dB        | ± 0.17dB                | 6.59 |
| -10 dBm       | - 1.0 dB      |             | 1.0 dB        | ± 0.17 dB               | 6.58 |
| -20 dBm       | - 1.0 dB      |             | 1.0 dB        | ± 0.17 dB               | 6.35 |
| -30 dBm       | - 1.0 dB      |             | 1.0 dB        | ± 0.18 dB               | 6.17 |
| -40 dBm       | - 1.0 dB      |             | 1.0 dB        | ± 0.18 dB               | 6.16 |
| -50 dBm       | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 8.99 |

### Change 4

Add TAR in Power Sweep Linearity Test to the following.

| STOP Power | Source Power | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR  |
|------------|--------------|---------------|-------------|---------------|-------------------------|------|
| -30 dBm    | -35 dBm      | - 0.5 dB      |             | 0.5 dB        | ± 0.072 dB              | 7.34 |
|            | -40 dBm      | - 0.5 dB      |             | 0.5 dB        | ± 0.073 dB              | 7.23 |
|            | -45 dBm      | - 0.5 dB      |             | 0.5 dB        | ± 0.078dB               | 6.77 |
|            | -50 dBm      | - 0.5 dB      |             | 0.5 dB        | ± 0.15 dB               | 3.57 |
| 15 dBm     | 10 dBm       | - 0.5 dB      |             | 0.5 dB        | ± 0.059 dB              | 8.96 |
|            | 5 dBm        | - 0.5 dB      |             | 0.5 dB        | ± 0.059 dB              | 8.95 |
|            | 0 dBm        | - 0.5 dB      |             | 0.5 dB        | ± 0.061 dB              | 8.67 |
|            | -5 dBm       | - 0.5 dB      |             | 0.5 dB        | ± 0.066 dB              | 7.92 |

### Change 5

Modify Measurement Uncertainty in HARMONICS/NON-HARMONIC SPURIOUS TEST

Harmonics

| Frequency | Harmonics Frequency | Test Result | Test Limit | Measurement Uncertainty |
|-----------|---------------------|-------------|------------|-------------------------|
| 10 kHz    | 20 kHz              |             | < -30 dBc  | ± 0.93 dB               |
|           | 30 kHz              |             | < -30 dBc  | ± 0.98 dB               |
| 500 kHz   | 1 MHz               |             | < -30 dBc  | ± 0.91 dB               |
|           | 1.5 MHz             |             | < -30 dBc  | ± 0.88 dB               |
| 10 MHz    | 20 MHz              |             | < -30 dBc  | ± 1.02 dB               |
|           | 30 MHz              |             | < -30 dBc  | ± 0.87 dB               |
| 100 MHz   | 200 MHz             |             | < -30 dBc  | ± 1.01 dB               |
|           | 300 MHz             |             | < -30 dBc  | ± 1.01 dB               |
| 250 MHz   | 500 MHz             |             | < -30 dBc  | ± 1.62 dB               |
|           | 750 MHz             |             | < -30 dBc  | ± 1.62 dB               |

|         |         |  |           |           |
|---------|---------|--|-----------|-----------|
| 500 MHz | 1 GHz   |  | < -30 dBc | ± 1.62 dB |
|         | 1.5 GHz |  | < -30 dBc | ± 1.63 dB |

#### Non-Harmonic Spurious

| Frequency | Harmonics Frequency | Test Result | Test Limit | Measurement Uncertainty |
|-----------|---------------------|-------------|------------|-------------------------|
| 10 kHz    | 830.00001 MHz       |             | < -30 dBc  | ± 1.52 dB               |
| 230 MHz   | 600 MHz             |             | < -30 dBc  | ± 2.10 dB               |
| 330 MHz   | 500 MHz             |             | < -30 dBc  | ± 1.72 dB               |
| 430 MHz   | 400 MHz             |             | < -30 dBc  | ± 1.70 dB               |
| 500 MHz   | 330 MHz             |             | < -30 dBc  | ± 1.63 dB               |

## Change 6

Add TAR in DC Bias Accuracy Test to the following.

|     | Dc Bias | Test Result | Test Limit   | Measurement Uncertainty | TAR   |
|-----|---------|-------------|--------------|-------------------------|-------|
| DCV | -40 V   |             | < ± 44 mV    | ± 0.858 mV              | 51.3  |
|     | -10 V   |             | < ± 14 mV    | ± 0.38 mV               | 36.8  |
|     | -4 V    |             | < ± 8 mV     | ± 0.0613 mV             | 130.5 |
|     | 0 V     |             | < ± 4 mV     | ± 0.0354 mV             | 113   |
|     | 4 V     |             | < ± 8 mV     | ± 0.0613 mV             | 130.5 |
|     | 10 V    |             | < ± 14 mV    | ± 0.380 mV              | 36.8  |
|     | 40 V    |             | < ± 44 mV    | ± 0.858 mV              | 51.3  |
| DCI | -100 mA |             | < ± 0.530 mA | ± 0.17 mA               | 32.2  |
|     | -10 mA  |             | < ± 0.080 mA | ± 0.77 uA               | 104.5 |
|     | -1 mA   |             | < ± 0.035 mA | ± 0.40 uA               | 87.9  |
|     | -20 uA  |             | < ± 0.030 mA | ± 0.49 uA               | 61.9  |
|     | 20 uA   |             | < ± 0.030 mA | ± 0.49 uA               | 61.9  |
|     | 1 mA    |             | < ± 0.035 mA | ± 0.40 uA               | 87.9  |
|     | 10 mA   |             | < ± 0.080 mA | ± 0.77 uA               | 104.5 |
|     | 100 mA  |             | < ± 0.530 mA | ± 0.17 mA               | 32.2  |

## Change 7

Add TAR in Absolute Amplitude Accuracy Test to the following.

Input R

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR  |
|-----------|---------------|-------------|---------------|-------------------------|------|
| 100 Hz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.21 |
| 200 Hz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.23 |
| 500 Hz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.23 |
| 1 kHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.24 |
| 2 kHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.25 |

|         |          |  |        |           |       |
|---------|----------|--|--------|-----------|-------|
| 5 kHz   | - 1.5 dB |  | 1.5 dB | ± 0.19 dB | 9.24  |
| 10 kHz  | - 1.5 dB |  | 1.5 dB | ± 0.19 dB | 9.22  |
| 20 kHz  | - 1.5 dB |  | 1.5 dB | ± 0.19 dB | 9.21  |
| 50 kHz  | - 1.5 dB |  | 1.5 dB | ± 0.19 dB | 9.10  |
| 100 kHz | - 1.5 dB |  | 1.5 dB | ± 0.17 dB | 10.04 |
| 200 kHz | - 1.5 dB |  | 1.5 dB | ± 0.17 dB | 10.04 |
| 500 kHz | - 1.5 dB |  | 1.5 dB | ± 0.18 dB | 9.56  |
| 1 MHz   | - 1.5 dB |  | 1.5 dB | ± 0.21 dB | 8.14  |
| 2 MHz   | - 1.5 dB |  | 1.5 dB | ± 0.21 dB | 8.13  |
| 5 MHz   | - 1.5 dB |  | 1.5 dB | ± 0.22 dB | 8.11  |
| 8 MHz   | - 1.5 dB |  | 1.5 dB | ± 0.22 dB | 8.12  |
| 10 MHz  | - 1.5 dB |  | 1.5 dB | ± 0.22 dB | 8.12  |
| 20 MHz  | - 1.5 dB |  | 1.5 dB | ± 0.21 dB | 8.14  |
| 50 MHz  | - 1.5 dB |  | 1.5 dB | ± 0.21 dB | 8.13  |
| 100 MHz | - 1.5 dB |  | 1.5 dB | ± 0.22 dB | 8.11  |
| 125 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.33  |
| 175 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.38  |
| 200 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.39  |
| 225 MHz | - 1.5 dB |  | 1.5 dB | ± 0.23 dB | 7.42  |
| 275 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.35  |
| 300 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.34  |
| 325 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.39  |
| 375 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.35  |
| 400 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.33  |
| 425 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.29  |
| 475 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.28  |
| 500 MHz | - 1.5 dB |  | 1.5 dB | ± 0.27 dB | 6.34  |

#### Input A

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-----------|---------------|-------------|---------------|-------------------------|-------|
| 100 Hz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.21  |
| 200 Hz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.23  |
| 500 Hz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.23  |
| 1 kHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.24  |
| 2 kHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.25  |
| 5 kHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.24  |
| 10 kHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.22  |
| 20 kHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.21  |
| 50 kHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.10  |
| 100 kHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.17 dB               | 10.04 |
| 200 kHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.17 dB               | 10.04 |
| 500 kHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.18 dB               | 9.56  |
| 1 MHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.21 dB               | 8.14  |
| 2 MHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.21 dB               | 8.13  |
| 5 MHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.22 dB               | 8.11  |
| 8 MHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.22 dB               | 8.12  |
| 10 MHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.22 dB               | 8.12  |
| 20 MHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.21 dB               | 8.14  |



|         |          |  |        |           |      |
|---------|----------|--|--------|-----------|------|
| 50 MHz  | - 1.5 dB |  | 1.5 dB | ± 0.21 dB | 8.13 |
| 100 MHz | - 1.5 dB |  | 1.5 dB | ± 0.22 dB | 8.11 |
| 125 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.33 |
| 175 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.38 |
| 200 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.39 |
| 225 MHz | - 1.5 dB |  | 1.5 dB | ± 0.23 dB | 7.42 |
| 275 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.35 |
| 300 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.34 |
| 325 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.39 |
| 375 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.35 |
| 400 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.33 |
| 425 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.29 |
| 475 MHz | - 1.5 dB |  | 1.5 dB | ± 0.24 dB | 7.28 |
| 500 MHz | - 1.5 dB |  | 1.5 dB | ± 0.27 dB | 6.34 |

#### Input B

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-----------|---------------|-------------|---------------|-------------------------|-------|
| 100 Hz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.21  |
| 200 Hz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.23  |
| 500 Hz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.23  |
| 1 kHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.24  |
| 2 kHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.25  |
| 5 kHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.24  |
| 10 kHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.22  |
| 20 kHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.21  |
| 50 kHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.19 dB               | 9.10  |
| 100 kHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.17 dB               | 10.04 |
| 200 kHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.17 dB               | 10.04 |
| 500 kHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.18 dB               | 9.56  |
| 1 MHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.21 dB               | 8.14  |
| 2 MHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.21 dB               | 8.13  |
| 5 MHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.22 dB               | 8.11  |
| 8 MHz     | - 1.5 dB      |             | 1.5 dB        | ± 0.22 dB               | 8.12  |
| 10 MHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.22 dB               | 8.12  |
| 20 MHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.21 dB               | 8.14  |
| 50 MHz    | - 1.5 dB      |             | 1.5 dB        | ± 0.21 dB               | 8.13  |
| 100 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.22 dB               | 8.11  |
| 125 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.33  |
| 175 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.38  |
| 200 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.39  |
| 225 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.23 dB               | 7.42  |
| 275 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.35  |
| 300 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.34  |
| 325 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.39  |
| 375 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.35  |
| 400 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.33  |
| 425 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.29  |
| 475 MHz   | - 1.5 dB      |             | 1.5 dB        | ± 0.24 dB               | 7.28  |

|         |          |  |        |           |      |
|---------|----------|--|--------|-----------|------|
| 500 MHz | - 1.5 dB |  | 1.5 dB | ± 0.27 dB | 6.34 |
|---------|----------|--|--------|-----------|------|

## Change 8

Add TAR in Magnitude Ratio / Phase Dynamic Accuracy Test to the following.

### A/R Measurement

| Input Level * | Measurement     | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|---------------|-----------------|---------------|-------------|---------------|-------------------------|-------|
| 0 dB          | Magnitude Ratio | - 0.40 dB     |             | 0.40 dB       | ± 0.011 dB              | 38.75 |
|               | Phase           | - 3.0 deg     |             | 3.0 deg       | ± 0.068 deg             | 44.40 |

| Input Level * | Measurement     | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|---------------|-----------------|---------------|-------------|---------------|-------------------------|-------|
| -20 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.0092 dB             | 5.45  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.064 deg             | 4.66  |
| -30 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.0093 dB             | 5.42  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.064 deg             | 4.69  |
| -40 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.0096 dB             | 5.23  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.064 deg             | 4.70  |
| -50 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.011 dB              | 4.39  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.065 deg             | 4.64  |
| -60 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.013 dB              | 3.78  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.076 deg             | 3.94  |
| -70 dB        | Magnitude Ratio | - 0.3 dB      |             | 0.3 dB        | ± 0.027 dB              | 11.59 |
|               | Phase           | - 1.8 deg     |             | 1.8 deg       | ± 0.15 deg              | 12.13 |
| -80 dB        | Magnitude Ratio | - 0.3 dB      |             | 0.3 dB        | ± 0.071 dB              | 4.34  |
|               | Phase           | - 1.8 deg     |             | 1.8 deg       | ± 0.43 deg              | 4.15  |
| -90 dB        | Magnitude Ratio | - 3.0 dB      |             | 3.0 dB        | ± 0.24 dB               | 17.58 |
|               | Phase           | - 18 deg      |             | 18 deg        | ± 1.6 deg               | 11.59 |
| -100 dB       | Magnitude Ratio | - 3.00 dB     |             | 3.00 dB       | ± 0.71 dB               | 5.61  |
|               | Phase           | - 18 deg      |             | 18 deg        | ± 5.3deg                | 3.39  |

### B/R Measurement

| Input Level * | Measurement     | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|---------------|-----------------|---------------|-------------|---------------|-------------------------|-------|
| 0 dB          | Magnitude Ratio | - 0.40 dB     |             | 0.40 dB       | ± 0.011 dB              | 38.75 |
|               | Phase           | - 3.0 deg     |             | 3.0 deg       | ± 0.068 deg             | 44.40 |

| Input Level * | Measurement     | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|---------------|-----------------|---------------|-------------|---------------|-------------------------|-------|
| -20 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.0092 dB             | 5.45  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.064 deg             | 4.66  |
| -30 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.0093 dB             | 5.42  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.064 deg             | 4.69  |
| -40 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.0096 dB             | 5.23  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.064 deg             | 4.70  |
| -50 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.011 dB              | 4.39  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.065 deg             | 4.64  |
| -60 dB        | Magnitude Ratio | - 0.05 dB     |             | 0.05 dB       | ± 0.013 dB              | 3.78  |
|               | Phase           | - 0.3 deg     |             | 0.3 deg       | ± 0.076 deg             | 3.94  |
| -70 dB        | Magnitude Ratio | - 0.3 dB      |             | 0.3 dB        | ± 0.027 dB              | 11.59 |
|               | Phase           | - 1.8 deg     |             | 1.8 deg       | ± 0.15 deg              | 12.13 |
| -80 dB        | Magnitude Ratio | - 0.3 dB      |             | 0.3 dB        | ± 0.071 dB              | 4.34  |
|               | Phase           | - 1.8 deg     |             | 1.8 deg       | ± 0.43 deg              | 4.15  |
| -90 dB        | Magnitude Ratio | - 3.0 dB      |             | 3.0 dB        | ± 0.24 dB               | 17.58 |
|               | Phase           | - 18 deg      |             | 18 deg        | ± 1.6 deg               | 11.59 |
| -100 dB       | Magnitude Ratio | - 3.00 dB     |             | 3.00 dB       | ± 0.71 dB               | 5.61  |
|               | Phase           | - 18 deg      |             | 18 deg        | ± 5.3 deg               | 3.39  |

## Change 9

Add TAR in Amplitude Fidelity Test to the following.

Input R

| dB from Reference Input Level | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-------------------------------|---------------|-------------|---------------|-------------------------|-------|
| 10 dB                         | - 0.05 dB     |             | 0.05 dB       | ± 0.016 dB              | 3.14  |
| -10 dB                        | - 0.05 dB     |             | 0.05 dB       | ± 0.015 dB              | 3.31  |
| -20 dB                        | - 0.05 dB     |             | 0.05 dB       | ± 0.015 dB              | 3.33  |
| -30 dB                        | - 0.07 dB     |             | 0.07 dB       | ± 0.015 dB              | 4.60  |
| -40 dB                        | - 0.15 dB     |             | 0.15 dB       | ± 0.018 dB              | 8.57  |
| -50 dB                        | - 0.35 dB     |             | 0.35 dB       | ± 0.026 dB              | 13.99 |
| -60 dB                        | - 0.8 dB      |             | 0.8 dB        | ± 0.084 dB              | 10.39 |
| -70 dB                        | - 1.8 dB      |             | 1.8 dB        | ± 0.227 dB              | 9.57  |

Input A

| dB from Reference Input | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR |
|-------------------------|---------------|-------------|---------------|-------------------------|-----|
|-------------------------|---------------|-------------|---------------|-------------------------|-----|

| Level  |           |  |         |            |       |
|--------|-----------|--|---------|------------|-------|
| 10 dB  | - 0.05 dB |  | 0.05 dB | ± 0.016 dB | 3.14  |
| -10 dB | - 0.05 dB |  | 0.05 dB | ± 0.015 dB | 3.31  |
| -20 dB | - 0.05 dB |  | 0.05 dB | ± 0.015 dB | 3.33  |
| -30 dB | - 0.07 dB |  | 0.07 dB | ± 0.015 dB | 4.60  |
| -40 dB | - 0.15 dB |  | 0.15 dB | ± 0.018 dB | 8.57  |
| -50 dB | - 0.35 dB |  | 0.35 dB | ± 0.026 dB | 13.99 |
| -60 dB | - 0.8 dB  |  | 0.8 dB  | ± 0.084 dB | 10.39 |
| -70 dB | - 1.8 dB  |  | 1.8 dB  | ± 0.227 dB | 9.57  |

#### Input B

| dB from Reference Input Level | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-------------------------------|---------------|-------------|---------------|-------------------------|-------|
| 10 dB                         | - 0.05 dB     |             | 0.05 dB       | ± 0.016 dB              | 3.14  |
| -10 dB                        | - 0.05 dB     |             | 0.05 dB       | ± 0.015 dB              | 3.31  |
| -20 dB                        | - 0.05 dB     |             | 0.05 dB       | ± 0.015 dB              | 3.33  |
| -30 dB                        | - 0.07 dB     |             | 0.07 dB       | ± 0.015 dB              | 4.60  |
| -40 dB                        | - 0.15 dB     |             | 0.15 dB       | ± 0.018 dB              | 8.57  |
| -50 dB                        | - 0.35 dB     |             | 0.35 dB       | ± 0.026 dB              | 13.99 |
| -60 dB                        | - 0.8 dB      |             | 0.8 dB        | ± 0.084 dB              | 10.39 |
| -70 dB                        | - 1.8 dB      |             | 1.8 dB        | ± 0.227 dB              | 9.57  |

#### Change 10

Add TAR in Input Attenuator Switching Uncertainty Test to the following.

#### Input R

| Input Attenuation | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-------------------|---------------|-------------|---------------|-------------------------|-------|
| 0 dB              | - 1 dB        |             | 1 dB          | ± 0.025 dB              | 45.16 |
| 20 dB             | - 1 dB        |             | 1 dB          | ± 0.024 dB              | 47.30 |
| 30 dB             | - 1 dB        |             | 1 dB          | ± 0.024 dB              | 46.78 |
| 40 dB             | - 1.5 dB      |             | 1.5 dB        | ± 0.027 dB              | 66.76 |
| 50 dB             | - 1.5 dB      |             | 1.5 dB        | ± 0.084 dB              | 21.20 |

#### Input A

| Input Attenuation | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-------------------|---------------|-------------|---------------|-------------------------|-------|
| 0 dB              | - 1 dB        |             | 1 dB          | ± 0.025 dB              | 45.16 |
| 20 dB             | - 1 dB        |             | 1 dB          | ± 0.024 dB              | 47.30 |
| 30 dB             | - 1 dB        |             | 1 dB          | ± 0.024 dB              | 46.78 |
| 40 dB             | - 1.5 dB      |             | 1.5 dB        | ± 0.027 dB              | 66.76 |
| 50 dB             | - 1.5 dB      |             | 1.5 dB        | ± 0.084 dB              | 21.20 |

#### Input B

| Input Attenuation | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-------------------|---------------|-------------|---------------|-------------------------|-------|
| 0 dB              | - 1 dB        |             | 1 dB          | ± 0.025 dB              | 45.16 |
| 20 dB             | - 1 dB        |             | 1 dB          | ± 0.024 dB              | 47.30 |
| 30 dB             | - 1 dB        |             | 1 dB          | ± 0.024 dB              | 46.78 |
| 40 dB             | - 1.5 dB      |             | 1.5 dB        | ± 0.027 dB              | 66.76 |
| 50 dB             | - 1.5 dB      |             | 1.5 dB        | ± 0.084 dB              | 21.20 |

## Change 11

Modify Measurement Uncertainty in NOISE SIDEBANDS TEST

INPUT R

| Frequency | Offset from Carrier | Test Result | Test Limit    | Measurement Uncertainty |
|-----------|---------------------|-------------|---------------|-------------------------|
| 10 MHz    | -1 kHz              |             | < -97 dBc/Hz  | ± 0.026 dB              |
|           | +1 kHz              |             | < -97 dBc/Hz  | ± 0.026 dB              |
|           | -10 kHz             |             | < -97 dBc/Hz  | ± 0.012 dB              |
|           | +10 kHz             |             | < -97 dBc/Hz  | ± 0.012 dB              |
|           | -100 kHz            |             | < -110 dBc/Hz | ± 0.025 dB              |
|           | +100 kHz            |             | < -110 dBc/Hz | ± 0.025 dB              |
|           | -1 MHz              |             | < -110 dBc/Hz | ± 0.015 dB              |
|           | +1 MHz              |             | < -110 dBc/Hz | ± 0.015 dB              |
| 100 MHz   | -1 kHz              |             | < -97 dBc/Hz  | ± 0.025 dB              |
|           | +1 kHz              |             | < -97 dBc/Hz  | ± 0.025 dB              |
|           | -10 kHz             |             | < -97 dBc/Hz  | ± 0.012 dB              |
|           | +10 kHz             |             | < -97 dBc/Hz  | ± 0.012 dB              |
|           | -100 kHz            |             | < -110 dBc/Hz | ± 0.026 dB              |
|           | +100 kHz            |             | < -110 dBc/Hz | ± 0.026 dB              |
|           | -1 MHz              |             | < -110 dBc/Hz | ± 0.014 dB              |
|           | +1 MHz              |             | < -110 dBc/Hz | ± 0.014 dB              |
| 500 MHz   | -1 kHz              |             | < -97 dBc/Hz  | ± 0.025 dB              |
|           | +1 kHz              |             | < -97 dBc/Hz  | ± 0.025 dB              |
|           | -10 kHz             |             | < -97 dBc/Hz  | ± 0.012 dB              |
|           | +10 kHz             |             | < -97 dBc/Hz  | ± 0.012 dB              |
|           | -100 kHz            |             | < -110 dBc/Hz | ± 0.026 dB              |
|           | +100 kHz            |             | < -110 dBc/Hz | ± 0.026 dB              |
|           | -1 MHz              |             | < -110 dBc/Hz | ± 0.016 dB              |
|           | +1 MHz              |             | < -110 dBc/Hz | ± 0.016 dB              |

## Change 12

Add TAR in Amplitude Accuracy/Frequency Response Test to the following.

Input R

Level Accuracy

| Minimum Limit | Test Result | Maximum Limit | Measurement | TAR  |
|---------------|-------------|---------------|-------------|------|
| - 0.8 dB      |             | 0.8 dB        | ± 0.14 dB   | 6.19 |

Frequency Response

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-----------|---------------|-------------|---------------|-------------------------|-------|
| 10 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.34 |
| 15 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.29 |
| 25 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.22 |
| 40 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.17 |
| 80 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.30 dB               | 14.16 |
| 100 Hz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 200 Hz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 500 Hz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 1 kHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 2 kHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.33 dB               | 4.36  |
| 5 kHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.39 dB               | 3.75  |
| 10 kHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 20 kHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.33 dB               | 4.36  |
| 50 kHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.39 dB               | 3.75  |
| 100 kHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 200 kHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.33 dB               | 4.36  |
| 500 kHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 1 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.098 dB              | 15.25 |
| 2 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.093 dB              | 16.07 |
| 5 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.090 dB              | 16.73 |
| 8 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.086 dB              | 17.54 |
| 10 MHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.088 dB              | 16.98 |
| 20 MHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.083 dB              | 18.06 |
| 100 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.082 dB              | 18.23 |
| 125 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.083 dB              | 18.18 |
| 150 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.082 dB              | 18.20 |
| 175 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.84 |
| 200 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.87 |
| 225 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.80 |
| 250 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.71 |
| 275 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.58 |
| 300 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.46 |
| 325 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.38 |
| 350 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.49 |
| 375 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.71 |
| 400 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.096 dB              | 15.69 |
| 425 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.097 dB              | 15.41 |
| 450 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.096 dB              | 15.61 |
| 475 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.094 dB              | 15.93 |
| 500 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.096dB               | 15.61 |

Input A

Level Accuracy

| Minimum Limit | Test Result | Maximum Limit | Measurement | TAR |
|---------------|-------------|---------------|-------------|-----|
|---------------|-------------|---------------|-------------|-----|

|          |  |        |           |      |
|----------|--|--------|-----------|------|
| - 0.8 dB |  | 0.8 dB | ± 0.14 dB | 6.19 |
|----------|--|--------|-----------|------|

## Frequency Response

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-----------|---------------|-------------|---------------|-------------------------|-------|
| 10 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.34 |
| 15 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.29 |
| 25 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.22 |
| 40 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.17 |
| 80 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.30 dB               | 14.16 |
| 100 Hz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 200 Hz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 500 Hz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 1 kHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 2 kHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.33 dB               | 4.36  |
| 5 kHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.39 dB               | 3.75  |
| 10 kHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 20 kHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.33 dB               | 4.36  |
| 50 kHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.39 dB               | 3.75  |
| 100 kHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 200 kHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.33 dB               | 4.36  |
| 500 kHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 1 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.098 dB              | 15.25 |
| 2 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.093 dB              | 16.07 |
| 5 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.090 dB              | 16.73 |
| 8 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.086 dB              | 17.54 |
| 10 MHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.088 dB              | 16.98 |
| 20 MHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.083 dB              | 18.06 |
| 100 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.082 dB              | 18.23 |
| 125 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.083 dB              | 18.18 |
| 150 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.082 dB              | 18.20 |
| 175 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.84 |
| 200 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.87 |
| 225 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.80 |
| 250 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.71 |
| 275 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.58 |
| 300 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.46 |
| 325 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.38 |
| 350 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.49 |
| 375 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.71 |
| 400 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.096 dB              | 15.69 |
| 425 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.097 dB              | 15.41 |
| 450 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.096 dB              | 15.61 |
| 475 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.094 dB              | 15.93 |
| 500 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.096 dB              | 15.61 |

# Input B

## Level Accuracy

| Minimum Limit | Test Result | Maximum Limit | Measurement | TAR  |
|---------------|-------------|---------------|-------------|------|
| - 0.8 dB      |             | 0.8 dB        | ± 0.14 dB   | 6.19 |

## Frequency Response

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty | TAR   |
|-----------|---------------|-------------|---------------|-------------------------|-------|
| 10 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.34 |
| 15 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.29 |
| 25 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.22 |
| 40 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.29 dB               | 14.17 |
| 80 Hz     | - 3.0 dB      |             | 3.0 dB        | ± 0.30 dB               | 14.16 |
| 100 Hz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 200 Hz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 500 Hz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 1 kHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 2 kHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.33 dB               | 4.36  |
| 5 kHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.39 dB               | 3.75  |
| 10 kHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 20 kHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.33 dB               | 4.36  |
| 50 kHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.39 dB               | 3.75  |
| 100 kHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 200 kHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.33 dB               | 4.36  |
| 500 kHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.30 dB               | 4.96  |
| 1 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.098 dB              | 15.25 |
| 2 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.093 dB              | 16.07 |
| 5 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.090 dB              | 16.73 |
| 8 MHz     | - 1.3 dB      |             | 1.3 dB        | ± 0.086 dB              | 17.54 |
| 10 MHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.088 dB              | 16.98 |
| 20 MHz    | - 1.3 dB      |             | 1.3 dB        | ± 0.083 dB              | 18.06 |
| 100 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.082 dB              | 18.23 |
| 125 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.083 dB              | 18.18 |
| 150 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.082 dB              | 18.20 |
| 175 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.84 |
| 200 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.87 |
| 225 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.80 |
| 250 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.71 |
| 275 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.58 |
| 300 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.46 |
| 325 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.38 |
| 350 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.49 |
| 375 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.10 dB               | 14.71 |
| 400 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.096 dB              | 15.69 |
| 425 MHz   | - 1.3 dB      |             | 1.3 dB        | ± 0.097 dB              | 15.41 |



|         |          |  |        |                |       |
|---------|----------|--|--------|----------------|-------|
| 450 MHz | - 1.3 dB |  | 1.3 dB | $\pm 0.096$ dB | 15.61 |
| 475 MHz | - 1.3 dB |  | 1.3 dB | $\pm 0.094$ dB | 15.93 |
| 500 MHz | - 1.3 dB |  | 1.3 dB | $\pm 0.096$ dB | 15.61 |

## Manual Change

Agilent Part No. N/A

May 2007

### Change 1

Change the procedure of the step 2.j (page 2-47 and 2-49) to the following.

j. Press **Ch2**, **Utility** and **STATISTICS on OFF**. (Then the softkey label changes to STATISTICS ON off.)

Press **Marker**, and turn RPG knob until marker is set to sweep STOP frequency point (500 MHz).

Press **Cal**, **MORE**, **ELEC DELAY MENU**, **MKR→DELAY** and, **ELECTRICAL DELAY**.

Then press **↑** or **↓** and turn the RPG knob to vary the electrical delay until the trace is in the most horizontal position.

## Manual Change

Agilent Part No. N/A

March 2007

### Change 1

Change the procedure of the step 3 (page 2-5) to the following.

3. Press **Meas**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **Preset** to initialize the 4395A.

Then set the controls as follows:

#### Control Settings

#### Key Strokes

Center Frequency: 50 MHz

**Center**, **5**, **0**, **M/μ**

Frequency Span: 0 Hz

**Span**, **ZERO SPAN**

Trigger Mode: Single

**Trigger**, **SINGLE**

The source power now is set to 0 dBm (preset value).

Manually trigger the 4395A each time the Center Frequency setting is changed.



# **Agilent 4395A Network/Spectrum/Impedance Analyzer**

# **Service Manual**

## **SERIAL NUMBERS**

This manual applies directly to instruments with serial number prefix JP1KE02197 or above, and MY41100220 or above.

For additional important information about serial numbers, read “Serial Number” in Appendix A.



**Agilent Technologies**

**Agilent Part No. 04395-90120**  
**Printed in Japan August 2002**

**Fifth Edition**

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## Notice

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Agilent Technologies Japan, LTD.  
Kobe Instrument Division  
1-3-2, Murotani, Nishi-Ku, Kobe-shi,  
Hyogo, 651-2241 Japan

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## Manual Printing History

The manual's printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates that are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

|                      |                                          |
|----------------------|------------------------------------------|
| February 1998 .....  | First Edition (Part Number 04395-90100)  |
| September 1998 ..... | Second Edition (Part Number 04395-90110) |
| June 2000 .....      | Third Edition (Part Number 04395-90110)  |
| March 2001 .....     | Fourth Edition (Part Number 04395-90110) |
| August 2002 .....    | Fifth Edition (Part Number 04395-90120)  |

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## Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific **WARNINGS** elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

*The Agilent Technologies Company assumes no liability for the customer's failure to comply with these requirements.*

---

### Note



4395A comply with INSTALLATION CATEGORY II and POLLUTION DEGREE 2 in IEC1010-1. 4395A are INDOOR USE product.

---

### Note



LEDs in 4395A are Class 1 in accordance with IEC825-1.  
CLASS 1 LED PRODUCT

---

## Ground The Instrument

To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

## DO NOT Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

## Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

## DO NOT Service Or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.



## DO NOT Substitute Parts Or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

## Dangerous Procedure Warnings

**Warnings** , such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

---

|                                                                                   |                                                                                                                                                                 |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Warning</b>                                                                    | <b>Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.</b> |
|  |                                                                                                                                                                 |

---

## Safety Symbols

General definitions of safety symbols used on equipment or in manuals are listed below.



Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual.



Alternating current.



Direct current.



On (Supply).



Off (Supply).



In position of push-button switch.



Out position of push-button switch.



Frame (or chassis) terminal. A connection to the frame (chassis) of the equipment which normally include all exposed metal structures.

### Warning



This **Warning** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

### Caution



This **Caution** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

### Note



This **Note** sign denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.



Affixed to product containing static sensitive devices use anti-static handling procedures to prevent electrostatic discharge damage to component.

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## Certification

Agilent Technologies Company certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility, or to the calibration facilities of other International Standards Organization members.

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## Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period of one year from the date of shipment, except that in the case of certain components listed in *General Information* of this manual, the warranty shall be for the specified period. During the warranty period, Agilent Technologies Company will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Agilent Technologies. Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country.

Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instruction when properly installed on that instrument. Agilent Technologies does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

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## Limitation Of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

*No other warranty is expressed or implied. Agilent Technologies specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.*

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## **Exclusive Remedies**

*The remedies provided herein are buyer's sole and exclusive remedies. Agilent Technologies shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.*

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## **Assistance**

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

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## Typeface Conventions

**Bold** Boldface type is used when a term is defined. For example: **icons** are symbols.

*Italics* Italic type is used for emphasis and for titles of manuals and other publications.

Italic type is also used for keyboard entries when a name or a variable must be typed in place of the words in italics. For example: **copy** *filename* means to type the word **copy**, to type a space, and then to type the name of a file such as **file1**.

**Computer** Computer font is used for on-screen prompts and messages.

**HARDKEYS** Labeled keys on the instrument front panel are enclosed in .

**SOFTKEYS** Softkeys located to the right of the CRT are enclosed in .

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## Documentation Map

The following manuals are available for the analyzer.

### **Operation Manual (Agilent Part Number 04395-90020)**

The Operation Manual describes all function accessed from the front panel keys and softkeys. It also provides information on options and accessories available, specifications, system performance, and some topics about the analyzer's features.

### **Programming Manual (Agilent Part Number 04395-90021)**

The Programming Manual shows how to write and use BASIC program to control the analyzer and describes how HP Instrument BASIC works with the analyzer..

### **HP Instrument BASIC Users Handbook (Agilent Part Number E2083-90005)**

The HP Instrument BASIC User's Handbook introduces you to the HP Instrument BASIC programming language, provide some helpful hints on getting the most use from it, and provide a general programming reference. It is divided into three books, *HP Instrument BASIC Programming Techniques*, *HP Instrument BASIC Interface Techniques*, and *HP Instrument BASIC Language Reference*.

### **Service Manual (Option 0BW only), (Agilent Part Number 04395-90120)**

The Service Manual explains how to adjust, troubleshoot, and repair the instrument. This manual is option 0BW only.



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## General Information

---

### INTRODUCTION

This *Service Manual* is a guide to servicing the 4395A Network/Spectrum/Impedance Analyzer. This manual provides information about performance test, adjustment, troubleshooting and repairing the analyzer.

---

### ORGANIZATION OF SERVICE MANUAL

This manual consists of major chapters listed below. The chapters are divided by tabs. This section describes the names of the tabs and the content of each chapter.

- *Performance Test* provides the procedures required for performance test of the analyzer.
- *Calculation Sheet* provides a calculation sheet for those performance tests that require additional calculation to determine the final test results.
- *Performance Test Record* provides a performance test record. The record sheets provides for all test items.
- *Adjustments* provides procedures for adjusting the analyzer after repair or replacement of an assembly. Some of the adjustments updates correction constants stored into the Flash ROM on the A1 CPU board. The correction constants is updated by using the adjustment program (PN 04395-18004).

---

#### Note

The next four, four chapters are the core troubleshooting chapters.



- 
- *Troubleshooting*. The troubleshooting strategy is to systematically verify portions of the analyzer, and thus narrow down the cause of a problem to the defective assembly. This chapter is the first of a series of troubleshooting procedures. It checks the operation of the analyzer independent of system peripherals, and suggests how to remedy system problems.
  - *Power Supply Troubleshooting*
  - *Digital Control Troubleshooting*
  - *Accessories Troubleshooting*

Each of the five functional group chapters above verifies its constituent assemblies until the faulty assembly is identified. *Accessories Troubleshooting* verifies external RF cables and calibration kit devices. *Accessories Troubleshooting* is the last of the gray-tabbed troubleshooting chapters.

---

**Note**

The following chapters are, for the most part, reference material.



- 
- *Replaceable Parts* provides part numbers and illustrations of the replaceable assemblies and miscellaneous chassis parts, together with ordering information.
  - *Post-Repair Procedures* contains the table of related service procedures. It is a table of adjustments and verification procedures to be performed after repair or replacement of each assembly.
  - *Appendices* contains the manual changes information (required to make this manual compatible with earlier shipment configurations of the analyzer), the motherboard pin assignment list, and the power requirement.
  - *Messages* contains the service related error message list.



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## PERFORMANCE TESTS

The analyzer's performance tests consist of the 21 tests listed in Table 1-1. These tests verify that the analyzer's performance meets the guaranteed specifications. See the *Operation Manual* for the specifications.

The analyzer's performance is categorized into two groups; performance in the network analyzer mode and performance in the spectrum analyzer mode. The third column in Table 1-1 indicates to which group the listed performance test belongs.

All tests can be performed without access to the interior of the instrument. The performance tests can be used to perform incoming inspection, and to verify that the analyzer meets performance specifications after repair.

**Table 1-1. Performance Tests**

| Test Number | Test Name                                     | Category <sup>1</sup> |
|-------------|-----------------------------------------------|-----------------------|
| 1           | Frequency Accuracy Test                       | NA                    |
| 2           | Source Level Accuracy/Flatness Test           | NA                    |
| 3           | Non-sweep Linearity Test                      | NA                    |
| 4           | Power Sweep Linearity Test                    | NA                    |
| 5           | Harmonics/Non-harmonic Test                   | NA                    |
| 6           | DC Bias Test (Option 001)                     | NA                    |
| 7           | Receiver Noise Level Test                     | NA                    |
| 8           | Input Crosstalk Test                          | NA                    |
| 9           | Input Impedance Test                          | NA                    |
| 10          | Absolute Amplitude Accuracy Test              | NA                    |
| 11          | Magnitude Ratio/Phase Dynamic Accuracy Test   | NA                    |
| 12          | Magnitude Ratio/Phase Frequency Response Test | NA                    |
| 13          | Displayed Average Noise Level Test            | SA                    |
| 14          | Amplitude Fidelity Test                       | SA                    |
| 15          | Input Attenuator Switching Uncertainty Test   | SA                    |
| 16          | Noise Sidebands Test                          | SA                    |
| 17          | Amplitude Accuracy/Frequency Response Test    | SA                    |
| 18          | Second Harmonic Distortion Test               | SA                    |
| 19          | Third Order Intermodulation Distortion Test   | SA                    |
| 20          | Other Spurious Test                           | SA                    |
| 21          | Residual Response Test                        | SA                    |

1 : NA: Network Analyzer Mode, SA: Spectrum Analyzer Mode

The test numbers in Table 1-1 are numbered according to the recommended sequence of performing tests. When performing more than one performance test, perform them in the order listed in Table 1-1. The first failed test indicates the problem you should troubleshoot first.

If the performance tests indicate that the analyzer is not operating within the specified limits, check the test setup. If the test setup is correct, see the *Adjustments* chapter or the *Troubleshooting* chapter for corrective action.

---

### Note



Allow the analyzer to warm up for at least 30 minutes before you execute any of the performance tests.

Perform all performance tests in an ambient temperature of  $23 \pm 5^{\circ}\text{C}$ .

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## CALIBRATION CYCLE

The analyzer requires periodic performance verification to remain in calibration. The frequency of performance verification depends on the operating and environmental conditions under which the analyzer is used. Verify the analyzer's performance at least once a year using the performance tests contained in this manual.

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## CALCULATION SHEET AND PERFORMANCE TEST RECORD

The Calculation Sheet and Performance Test Record tables are provided in Chapter 3 and Chapter 4.

### Calculation Sheet

Use the calculation sheet as an aid for recording raw measurement data and calculating the performance test results. Calculation sheet entries are provided only for performance tests in which calculations are required to obtain the test results.

### Performance Test Record

The performance test record lists all test points, acceptable test limits, and measurement uncertainties (if applicable). The measurement uncertainty shows how accurately the analyzer's specifications are measured and depends on the test equipment used. The listed measurement uncertainties are valid only when the recommended equipment is used.

### How to Use

The following procedure is recommended when using the calculation sheet and the performance test record:

1. Make extra copies of the calculation sheet and the performance test record.
2. Follow the performance test procedure and record the measured data in the specified column in the calculation sheet. For tests where no calculation sheet entry spaces are provided, record the measured values directly in the performance test record.
3. Calculate the test result using the appropriate equation given in the calculation sheet. Record the test results in the Test Result column in the calculation sheet.
4. When appropriate, copy the test results from the calculation sheet to the performance test record.
5. Keep the performance test record for tracking gradual changes in test results over long periods of time.

## RECOMMENDED TEST EQUIPMENT

Table 1-2 lists the equipment required for performance testing the analyzer. Other equipment may be substituted if the equipment meets or exceeds the critical specifications given in Table 1-2.

**Table 1-2. Recommended Test Equipment**

| Equipment                          | Critical Specifications                                                                                                                    | Recommended Model/<br>Agilent Part Number    | Qty |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----|
| Frequency Counter                  | Frequency Range: 500 MHz, Time Base Error: $\leq \pm 1.9 \times 10^{-7}$ /year                                                             | 5334B <sup>1</sup>                           | 1   |
| Frequency Standard <sup>2</sup>    | Frequency: 10 MHz, Time Base Error: $\leq \pm 1 \times 10^{-10}$ /year                                                                     | 5061B                                        | 1   |
| Spectrum Analyzer                  | Frequency Range: 100 Hz to 1.5 GHz                                                                                                         | 8566A/B                                      | 1   |
| Network Analyzer                   | Frequency Range: 300 kHz to 500 MHz                                                                                                        | 8753A/B/C                                    | 1   |
| Power Meter                        | No substitute                                                                                                                              | 436A Opt. 022, 437B, or 438A                 | 1   |
| Power Sensor                       | Frequency Range : 1 MHz to 500 MHz, Power: -26 dBm to 0 dBm                                                                                | 8482A                                        | 1   |
| Power Sensor                       | Frequency Range : 1 MHz to 500 MHz, Power: -60 dBm to -35 dBm                                                                              | 8481D                                        | 1   |
| Function Generator                 | Frequency Range : 10 Hz to 500 kHz, Level Accuracy: $\pm 0.2$ dB, Return loss: $> 20$ dB                                                   | 3325A                                        | 1   |
| Multimeter                         | No substitute                                                                                                                              | 3458A                                        | 1   |
| Signal Generator                   | Frequency Range : 1 MHz to 500 MHz, SSB Phase Noise at 100 Hz offset: $< -112$ dBc/Hz, SSB Phase Noise at 1 kHz offset: $< -121$ dBc/Hz    | 8663A                                        | 1   |
| Signal Generator                   | Frequency Range : 50 MHz to 100.2 MHz, SSB Phase Noise at 100 Hz offset: $< -112$ dBc/Hz, SSB Phase Noise at 1 kHz offset: $< -121$ dBc/Hz | 8642B                                        | 1   |
| Step Attenuator <sup>3</sup>       | Attenuation Range : 0 dB to 100 dB, Step: 10 dB, VSWR: $\leq 1.02$                                                                         | 8496G Opt. 001 and H60 <sup>4</sup>          | 1   |
| Attenuator/Switch Driver           | No substitute                                                                                                                              | 11713A <sup>5</sup>                          | 1   |
| 50 $\Omega$ Type-N Calibration Kit | No substitute                                                                                                                              | 85032B                                       | 1   |
| T/R Test Sets                      | Frequency Range: 300 kHz to 500 MHz, Directivity: $\geq 40$ dB                                                                             | 85044A                                       | 1   |
| 50 MHz Low Pass Filter             | Rejection at 75 MHz: $\geq 60$ dB                                                                                                          | PN 0955-0306                                 | 1   |
| 50 $\Omega$ Feedthrough            | Rejection at 75 MHz: $\geq 60$ dB                                                                                                          | PN 04192-61002                               | 1   |
| Termination                        | 50 $\Omega$ Termination, type-N(m)                                                                                                         | 909C Opt. 012 or part of 85032B <sup>6</sup> | 3   |

**Table 1-2. Recommended Test Equipment (continued)**

| Equipment               | Critical Specifications                                              | Recommended Model/<br>Agilent Part Number | Qty |
|-------------------------|----------------------------------------------------------------------|-------------------------------------------|-----|
| 6 dB Fixed Attenuation  | 50 $\Omega$ , N(m)-N(f)                                              | 8491A Opt. 006                            | 2   |
| 6 dB Fixed Attenuation  | 50 $\Omega$ , N(m)-N(f), VSWR $\leq$ 1.015                           | 8491A Opt. 006 & Opt. H60 <sup>7</sup>    | 2   |
| 10 dB Fixed Attenuation | 50 $\Omega$ , N(m)-N(f), VSWR $\leq$ 1.015                           | 8491A Opt. 010 & Opt. H60 <sup>8</sup>    | 1   |
| Two-Way Power Splitter  | Frequency Range: 100 kHz to 500 MHz, Output Tracking: $\leq$ 0.15 dB | 11667A                                    | 1   |
| Cables                  | Type-N cable, 50 $\Omega$                                            | 11500B or part of 11851B <sup>9</sup>     | 4   |
|                         | BNC cable, 61 cm, 50 $\Omega$                                        | PN 8120-1839                              | 2   |
|                         | BNC cable, 122 cm, 50 $\Omega$                                       | PN 8120-1840                              | 2   |
| Adapters                | BNC(f)-BNC(f) adapter, 50 $\Omega$                                   | PN 1250-0080                              | 1   |
|                         | Tee BNC(m)-(f)-(f) adapter, 50 $\Omega$                              | PN 1250-0781                              | 1   |
|                         | BNC(f)-Dual Banana Plug Adapter, 50 $\Omega$                         | PN 1251-2277                              | 1   |
|                         | N(m)-N(m) adapter, 50 $\Omega$                                       | PN 1250-1475                              | 1   |
|                         | N(m)-BNC(f) adapter, 50 $\Omega$                                     | PN 1250-0780                              | 2   |
|                         | APC7.5-N(f) adapter, 50 $\Omega$                                     | 11524A or part of 85032B <sup>10</sup>    | 1   |

- 1: Option 001 (optional time base) is not required, when a frequency standard in Table 1-2 is available.
- 2: Required for testing an analyzer equipped with Option 1D5 (High Stability Frequency Reference).
- 3: Calibration values at 50 MHz are required in the tests. See the *Calibration Data Required for Step Attenuators* later in this chapter.
- 4: An 8496G step attenuator with required low VSWR ( $\leq$  1.02) can be purchased by specifying option H60.
- 5: Required when an 8496G step attenuator is used in the tests.
- 6: The 85032B includes a type-N(m) 50  $\Omega$  termination.
- 7: An 8491A Opt. 006 fixed attenuator with required low VSWR ( $\leq$  1.015) can be purchased by specifying Opt. H60.
- 8: An 8491A Opt. 010 fixed attenuator with required low VSWR ( $\leq$  1.015) can be purchased by specifying Opt. H60.
- 9: The 11851B includes three N(m)-N(m) cables of 61 cm and a N(m)-N(m) cable of 88 cm.
- 10: The 85032B includes two APC7.5-N(f) adapters.

## Calibration Data Required for Step Attenuator

The four performance tests listed below measure the analyzer's performance against a known standard (the attenuation values at a frequency 50 MHz of the 8496G Opt. 001 and H60 step attenuators).

3. Non-Sweep Power Linearity Test
11. Magnitude Ratio/Phase Dynamic Accuracy Test
14. Amplitude Fidelity Test
15. Input Attenuator Switching Uncertainty Test

These tests require the calibrated values of the attenuators listed in Table 1-3. The attenuation values (referenced to 0 dB setting) are required in the calculation sheet. The attenuation values used in the tests are listed in each calculation sheet.

## 1-6 General Information

**Table 1-3. Calibration Data Required for 8496G Opt. 001 and H60**

| Frequency | Attenuation | Uncertainty      |
|-----------|-------------|------------------|
| 50 MHz    | 0 dB        | $\leq 0.0037$ dB |
|           | 10 dB       | $\leq 0.0042$ dB |
|           | 20 dB       | $\leq 0.0046$ dB |
|           | 30 dB       | $\leq 0.0052$ dB |
|           | 40 dB       | $\leq 0.0079$ dB |
|           | 50 dB       | $\leq 0.0125$ dB |
|           | 60 dB       | $\leq 0.0144$ dB |
|           | 70 dB       | $\leq 0.0327$ dB |
|           | 80 dB       | $\leq 0.0532$ dB |
|           | 90 dB       | $\leq 0.0543$ dB |
|           | 100 dB      | $\leq 0.0850$ dB |

The calibration uncertainty is the primary source of measurement error in performance tests. The measurement uncertainties listed in the performance test record of Chapter 4 are valid only when the uncertainty of the step attenuation data satisfies that given in the third column of Table 1-3.

The calibration of step attenuators, 8496G Opt. 001 and H60, are available at Agilent Technologies. For information about the calibration and the available uncertainties, contact your nearest Agilent Technologies service center.

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**Note**


The 8496G Opt. 001 and H60 programmable step attenuator has four attenuation segments, 10 dB segment, 20 dB segment, and two 40 dB segments. Each attenuation from 10 dB to 70 dB is obtained by combining these segments. The attenuations from 40 dB to 70 dB depend on the 40 dB segment that is used.

When setting the step attenuator for the calibration, specify one of the 40 dB segments for attenuations from 40 dB to 70 dB. Then use the specified segment in the tests.

---



## Performance Tests

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### INTRODUCTION

This chapter contains the performance test procedures. The test procedures listed in Table 1-1 are described sequentially in the following pages.

The test name indicates the tested performance and to which performance group the tested performance belongs to. *NA* indicates the performance test belongs to the network analyzer mode performance group. *SA* indicates the performance test belongs to the spectrum analyzer mode performance group.

Each procedure consists of the following parts:

|                        |                                                 |
|------------------------|-------------------------------------------------|
| <b>Description:</b>    | describes the test procedure.                   |
| <b>Specification:</b>  | describes the performance verified in the test. |
| <b>Test Equipment:</b> | describes test equipment required in the test.  |
| <b>Procedure:</b>      | describes the test procedure step by step.      |

---

|                                                                                     |                                                                                                        |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| <b>Note</b>                                                                         | Allow the analyzer to warm up for at least 30 minutes before you execute any of the performance tests. |
|  | Perform all performance tests in an ambient temperature of $23 \pm 5^{\circ}\text{C}$ .                |

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|                                                                                     |                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Note</b>                                                                         | Before performing any tests, make extra copies of the calculation sheet in Chapter 3 and the performance test record in Chapter 4. These are required in the test procedure. For an explanation of how to use these records, see the <i>CALCULATION SHEET AND PERFORMANCE TEST RECORD</i> in Chapter 1. |
|  |                                                                                                                                                                                                                                                                                                         |

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# 1. FREQUENCY ACCURACY TEST (NA)

## Description

This test uses a frequency counter and a frequency standard to measure the actual frequency of the 4395A RF OUT signal when it is tuned to 100 MHz. This test checks the frequency accuracy of the internal frequency reference (or the high stability frequency reference for Option 1D5).

## Specification

### Frequency reference accuracy

@23±5°C, referenced to 23°C ..... <±5.5 ppm

### Precision frequency reference accuracy (option 1D5)

@0°C to 55°C, referenced to 23°C ..... <±0.13 ppm

## Test Equipment

### For testing a standard 4395A (not equipped without Opt. 1D5)

Frequency Counter ..... 5334B

BNC cable, 61 cm ..... PN 8120-1839

N(m)-BNC(f) adapter ..... PN 1250-0780

### For testing an 4395A equipped with Opt. 1D5

Frequency Counter ..... 5334B

Frequency Standard ..... 5061B <sup>1</sup>

BNC cable, 61 cm ..... PN 8120-1839

BNC cable, 122 cm ..... PN 8120-1840

N(m)-BNC(f) adapter ..... PN 1250-0780

1: The 5061B can be replaced with any 10 MHz frequency standard with time base error of  $< \pm 1 \times 10^{-10}$ /year.

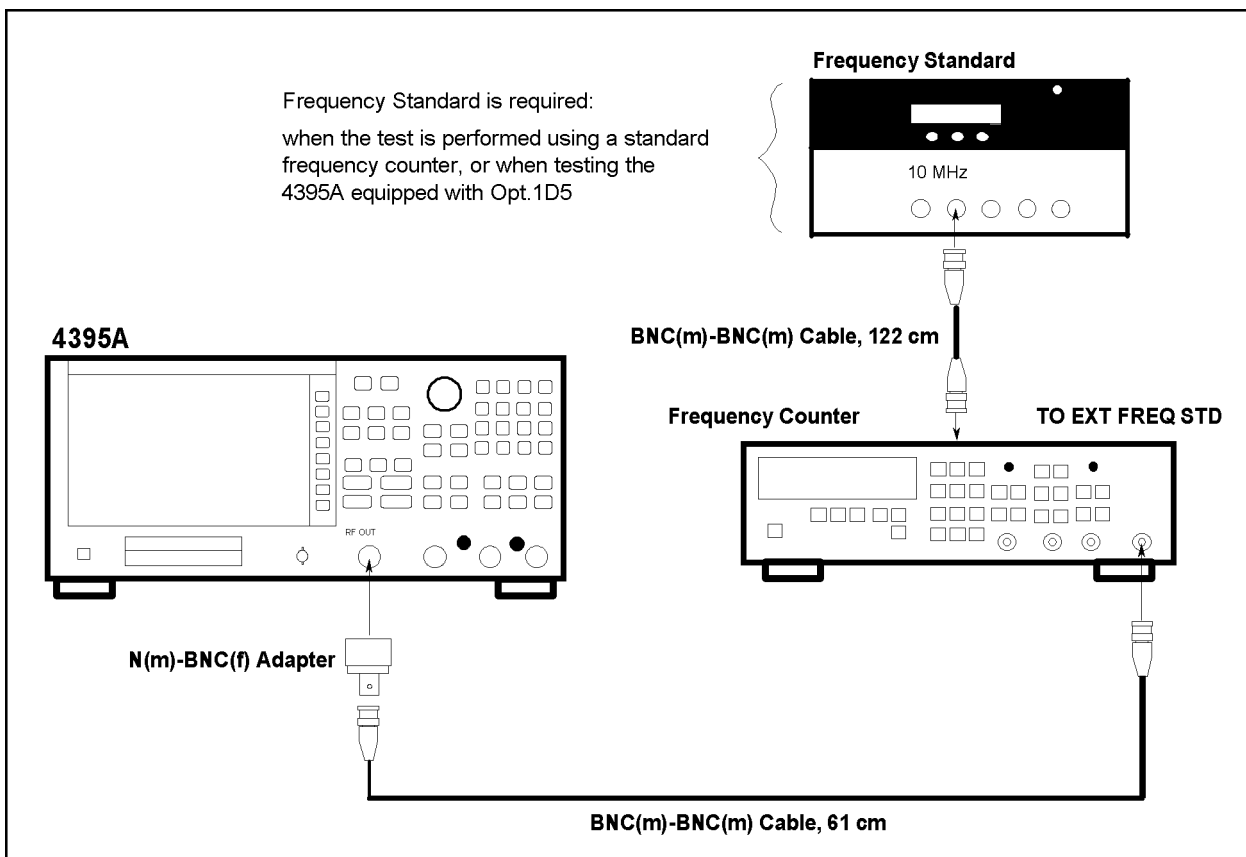
## Procedure

1. Connect the test equipment as shown in Figure 2-1.

For testing a standard 4395A (not equipped with Option 1D5), do not connect any cable to the EXT REF Input connector in the 4395A rear panel.

For testing an 4395A equipped with Option 1D5, connect a BNC(m)-BNC(m) cable between the EXT REF Input connector and the REF OVEN connector on the 4395A rear panel.





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**Figure 2-1. Frequency Accuracy Test Setup**

- Initialize the frequency counter. Then set the frequency standard is connected)

**Controls**

Gate Time

INT/EXT Switch (rear panel)

**Settings**

1 sec.

External(When the frequency standard is connected).

- Press **[Meas]**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Center Frequency: 100 MHz

Frequency Span: ZERO

**Key Strokes**

**[Center]**, **1.0.0.M/μ**

**[Span]**, **ZERO SPAN**

The source power now is set to 0 dBm (preset value).

- Press **[Trigger]**, **SINGLE** to make a sweep. Wait for the frequency counter reading to settle.
- Record the frequency counter reading to 1 Hz resolution in the performance test record ("Test Result" column).

---

## 2. SOURCE LEVEL ACCURACY/FLATNESS TEST (NA)

### Description

This test uses a power meter and a power sensor to measure the actual power level of the RF OUT signal at several frequencies from 10 Hz to 500 MHz when the signal amplitude is set to 0 dBm. The level accuracy is checked at a frequency 50 MHz. The level flatness is calculated as power deviation from the power reading taken at 50 MHz.

### Specification

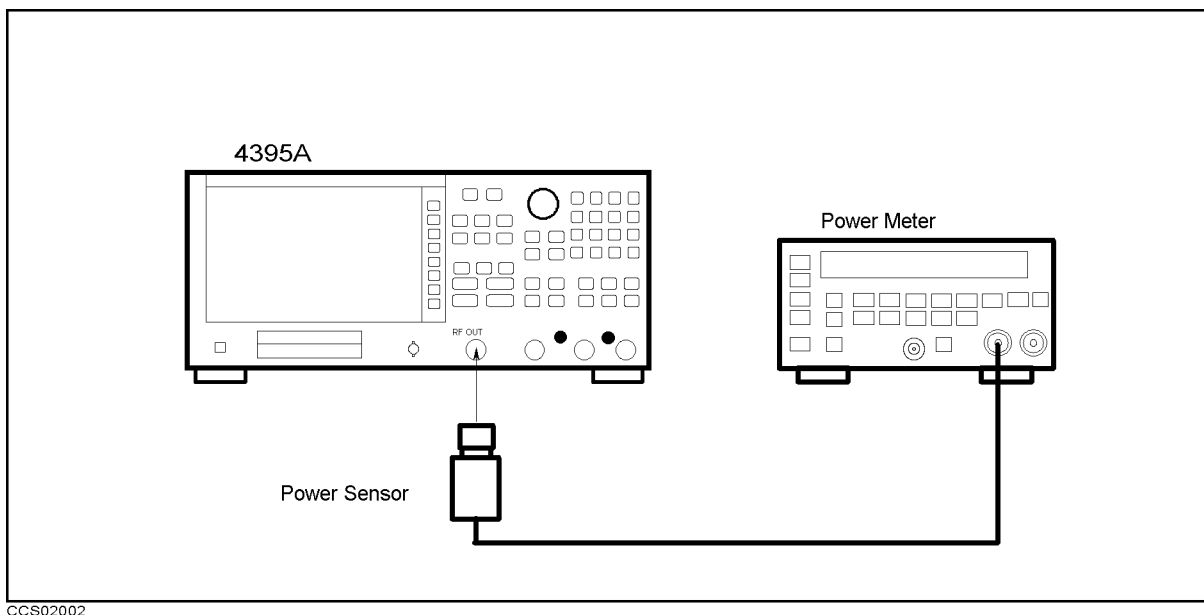
|                                                 |          |
|-------------------------------------------------|----------|
| <b>Level accuracy</b>                           |          |
| @23±5°C, 50 MHz, 0 dBm output .....             | <±1.0 dB |
| <b>Flatness</b>                                 |          |
| @23±5°C, relative to 50 MHz, 0 dBm output ..... | ±2.0 dB  |

### Test Equipment

|                                       |                              |
|---------------------------------------|------------------------------|
| Power Meter .....                     | 436A Opt. 022, 437B, or 438A |
| Power Sensor .....                    | 8482A                        |
| Multimeter .....                      | 3458A                        |
| 50 Ω Feedthrough .....                | PN 04192-61002               |
| BNC cable, 61 cm .....                | PN 8120-1839                 |
| N(m)-BNC(f) adapter .....             | PN 1250-0780                 |
| BNC(f)-Dual Banana Plug Adapter ..... | PN 1251-2277                 |

### Procedure

1. Connect the power sensor to the power meter. Calibrate the power meter for the power sensor.
2. Connect the test equipment as shown in Figure 2-2.



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**Figure 2-2. Source Level Accuracy Test Setup**

3. Press **[Meas]**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Center Frequency: 50 MHz

Frequency Span: 0 Hz

**Key Strokes**

**[Center]**, **[5]**, **[0]**, **[M/μ]**

**[Span]**, **ZERO SPAN**

The source power now is set to 0 dBm (preset value).

4. **Source Level Accuracy Test**

- a. Wait for the power meter reading to settle.
- b. Record the power meter reading in the performance test record (“Test Result” column for the level accuracy test).

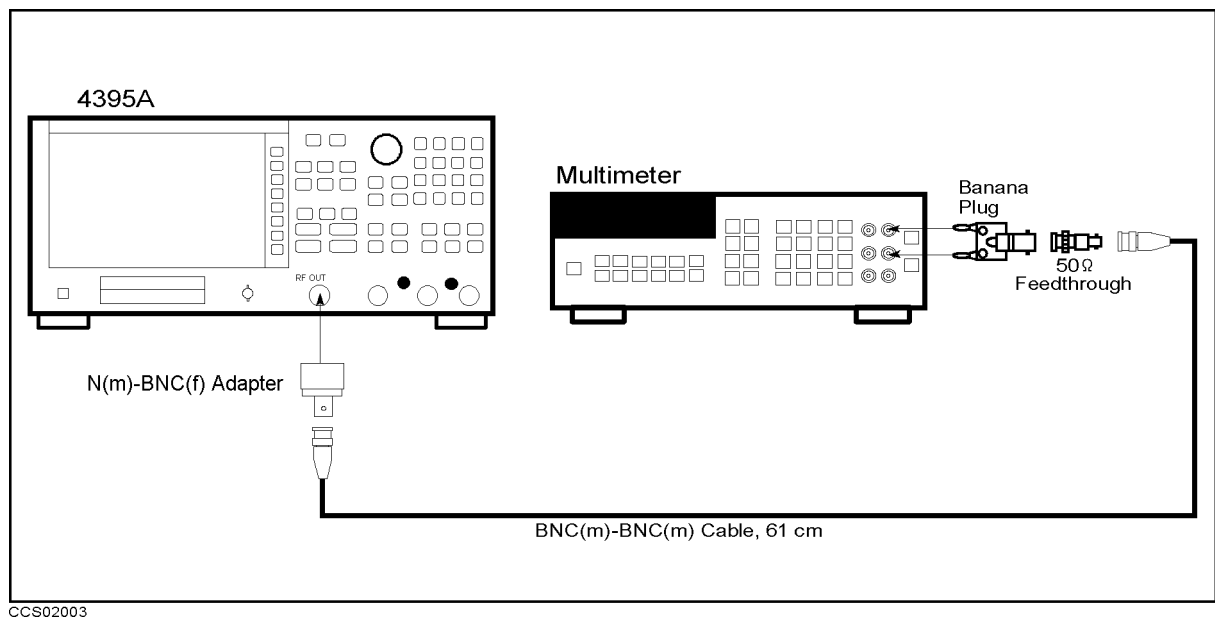
5. **Source Level Flatness Test (High Frequencies)**

- a. Record the test result of the level accuracy test in the calculation sheet (“Power Meter Reading [ref]” column for the level flatness test).
- b. Press **[Center]**, **[1]**, **[M/μ]** to change the 4395A center frequency to the first flatness test frequency 1 MHz listed in Table 2-1. Table 2-1 lists flatness test points for high frequencies.

**Table 2-1. Source Level Flatness Test Settings 1**

| 4395 A<br>Center Frequency |
|----------------------------|
| 1 MHz                      |
| 3 MHz                      |
| 10 MHz                     |
| 45 MHz                     |
| 75 MHz                     |
| 110 MHz                    |
| 140 MHz                    |
| 190 MHz                    |
| 235 MHz                    |
| 290 MHz                    |
| 345 MHz                    |
| 400 MHz                    |
| 445 MHz                    |
| 470 MHz                    |
| 500 MHz                    |

- c. Wait for the power meter reading to settle. Then record the reading in the calculation sheet (“Power Meter Reading” column).
  - d. Change the 4395A center frequency in accordance with Table 2-1 and repeat step 5-c for each frequency.
  - e. Calculate test results using the equation given in the calculation sheet. Record the test results in the performance test record.
- 6. Source Level Flatness Test (Low Frequencies)**
- a. Connect the test equipment as shown in Figure 2-3.



**Figure 2-3. Source Level Flatness Test Setup**

- b. Initialize the multimeter. Then set the controls as follows:

| <b>Controls</b>       | <b>Settings</b>                 |
|-----------------------|---------------------------------|
| Measurement Function  | AC Volts Mode                   |
| Display Reading Value | dBm Reading Value               |
| Measurement Method    | Synchronous Sampling Conversion |
| NPLC                  | 100                             |

- c. Press **Center**, **1**, **0**, **x1** to change the 4395A center frequency to the first flatness test frequency 10 Hz listed in Table 2-2. Table 2-2 lists flatness test points for low frequencies.

**Table 2-2. Source Level Flatness Test Settings 2**

| <b>4395A<br/>Center Frequency</b> |
|-----------------------------------|
| 10 Hz                             |
| 50 Hz                             |
| 500 Hz                            |
| 2 kHz                             |
| 12 kHz                            |
| 60 kHz                            |
| 160 kHz                           |
| 500 kHz                           |

- d. Wait for the multimeter reading to settle. Then record the reading in the calculation sheet (“Power Meter Reading” column).
- e. Change the 4395A center frequency in accordance with Table 2-2 and repeat step 6-d for each frequency.
- f. Calculate test results using the equation given in the calculation sheet. Record the test results in the performance test record.

### 3. NON-SWEEP POWER LINEARITY TEST (NA)

#### Description

This test uses a power meter and a high sensitivity power sensor to measure the actual power of the 4395A RF OUT signal at several power settings and then calculates the power linearity. The power linearity is referenced to a power level of 0 dBm.

In this test, the input power to the power sensor is maintained between  $-60$  dBm and  $-30$  dBm using the step attenuator. This reduces measurement uncertainty caused by the power sensor’s non-linearity and noise. The actual power of the RF OUT signal is calculated by adding the attenuation used and the power meter reading. Therefore, this test requires the calibrated attenuation values of the step attenuator at 50 MHz.

#### Specification

##### Level linearity

| Output Power                       | Linearity <sup>1</sup> |
|------------------------------------|------------------------|
| $-40\text{ dBm} \leq \text{power}$ | $\pm 1.0\text{ dB}$    |
| $\text{power} < -40\text{ dBm}$    | $\pm 1.5\text{ dB}$    |

1 : @ $23\pm 5^{\circ}\text{C}$ , relative to 0 dBm output

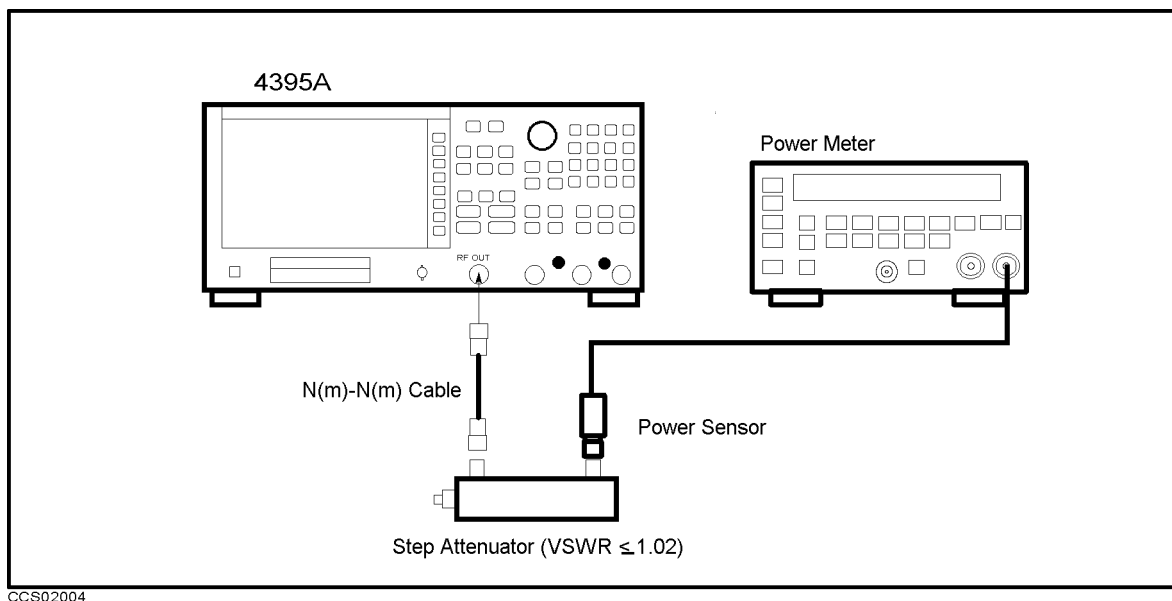
#### Test Equipment

|                                                                   |                              |
|-------------------------------------------------------------------|------------------------------|
| Power Meter .....                                                 | 436A Opt. 022, 437B, or 438A |
| Power Sensor .....                                                | 8481D                        |
| Type-N Cable, 61 cm .....                                         | 11500B or part of 11851B     |
| Step Attenuator <sup>1</sup> , 10 dB Step, VSWR $\leq 1.02$ ..... | 8496G Opt. 001 and H60       |
| Attenuator driver .....                                           | 11713A                       |

1: Calibration values for attenuation settings of 10 dB to 50 dB at 50 MHz are required.

#### Procedure

1. Record the step attenuator 50 MHz calibration values in the calculation sheet (“Calibration Value” column).
2. Connect the power sensor to the power meter, and calibrate the power meter for the power sensor.
3. Set the step attenuator to 30 dB before connecting the test equipment. This protects the power sensor from excess input.
4. Connect the test equipment as shown in Figure 2-4.



**Figure 2-4. Non-sweep Power Linearity Test Setup**

- Press **[Meas]**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Center Frequency: 50 MHz

Frequency Span: 0 Hz

**Key Strokes**

**[Center]**, **[5]**, **[0]**, **[M/μ]**

**[Span]**, **ZERO SPAN**

The source power now is set to 0 dBm (preset value).

- Set the step attenuator to the first setting 30 dB listed in the second column of Table 2-3.
- Wait for the power meter reading to settle.
- Record the power meter reading in the calculation sheet. Use “Power Meter Reading” column of the calculation sheet for the reference 0 dBm.

**Table 2-3. Non-Sweep Power Linearity Test Settings**

| 4395A<br>Source Power | Step Attenuator |
|-----------------------|-----------------|
| 0 dBm                 | 30 dB           |
| +15 dBm               | 50 dB           |
| +10 dBm               | 40 dB           |
| −10 dBm               | 20 dB           |
| −20 dBm               | 10 dB           |
| −30 dBm               | 10 dB           |
| −40 dBm               | 10 dB           |
| −50 dBm               | 10 dB           |

9. Change the source power and the step attenuator setting in accordance with Table 2-3. Record the power meter reading in the calculation sheet. Use “Power Meter Reading” column of the calculation sheet for the non-sweep power linearity test.
10. Repeat step 9 for each setting.
11. Calculate the test results using the equations given in the calculation sheet. Record the test results in the performance test record.



---

## 4. POWER SWEEP LINEARITY TEST (NA)

### Description

This test sets the 4395A to the power sweep mode and then makes a power sweep from  $-50$  dBm to  $-30$  dBm and  $-5$  dBm to  $15$  dBm in  $5$  dB steps. Using a power meter and a high sensitivity power sensor, the actual power of the 4395A RF OUT signal at each sweep point is measured. Then the power sweep linearity for a sweep span  $\leq +20$  dB is calculated. The power linearity is specified as values relative to the stop power.

This test uses a step attenuator to maintain the power sensor input level  $\leq -35$  dBm. This reduces the measurement uncertainty caused by the power sensor's linearity error. The actual power of the RF OUT signal is calculated by adding the attenuation used and the power meter reading.

### Specification

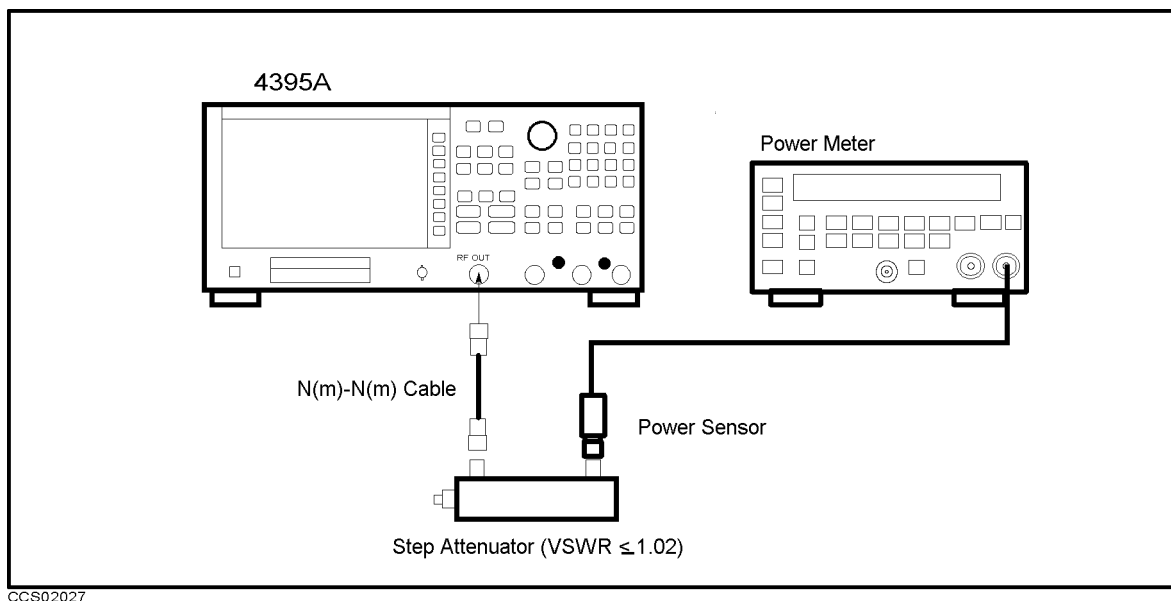
|                                                                   |              |
|-------------------------------------------------------------------|--------------|
| Sweep range .....                                                 | 20 dB        |
| Sweep linearity                                                   |              |
| @ $23\pm5^{\circ}\text{C}$ , 50 MHz, relative to stop power ..... | $\pm 0.5$ dB |

### Test Equipment

|                                                      |                              |
|------------------------------------------------------|------------------------------|
| Power Meter .....                                    | 436A Opt. 022, 437B, or 438A |
| Power Sensor .....                                   | .8481D                       |
| Step Attenuator, 10 dB Step , VSWR $\leq 1.02$ ..... | .8496G Opt. 001 and H60      |
| Attenuator driver .....                              | 11713A                       |
| Type-N Cable, 61 cm .....                            | 11500B or part of 11851B     |

### Procedure

1. Connect the power sensor to the power meter. Then calibrate the power meter for the power sensor.
2. Set the step attenuator to 30 dB before connecting the test equipment. This protects the power sensor from excess input.
3. Connect the test equipment as shown in Figure 2-5.



**Figure 2-5. Power Sweep Linearity Test Setup**

4. Press **[Meas]**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Power Sweep

CW Frequency: 50 MHz

Start Power: -50 dBm

Stop Power: -30 dBm

Number of Points: 5

Trigger: Manual

Trigger Event: On Point

**Key Strokes**

**[Sweep]**, **SWEEP TYPE MENU**, **POWER SWEEP**

**[Source]**, **CW FREQ**, **[5]**, **[0]**, **[M/μ]**

**[Start]**, **[-]**, **[5]**, **[0]**, **[x1]**

**[Stop]**, **[-]**, **[3]**, **[0]**, **[x1]**

**[Sweep]**, **NUMBER of POINTS**, **[5]**, **[x1]**

**[Trigger]**, **TRIGGER[xxx]**, **MANUAL**

**[Trigger]**, **TRIGGER[xxx]**, **TRIG EVENT [ON SWEEP]**

(Then the softkey label changes to

**TRIGGER [ON POINT]**

5. Press **[Trigger]**, **SINGLE**, **TRIGGER: [MANUAL]**, **MANUAL** to start a power sweep and to set the 4395A power to the first sweep point of -50 dBm listed in Table 2-4. Table 2-4 lists test settings. Verify that the step attenuator is set to 10 dB.

**Table 2-4. Power Sweep Linearity Test Settings 1**

| 4395A<br>Source Power | Step Attenuator |
|-----------------------|-----------------|
| -50 dBm               | 10 dB           |
| -45 dBm               | 10 dB           |
| -40 dBm               | 10 dB           |
| -35 dBm               | 10 dB           |
| -30 dBm               | 10 dB           |

6. Wait for the power meter reading to settle.
7. Record the power meter reading in the calculation sheet (“Power Meter Reading” column).
8. Repeat the following steps until a power sweep completed.
  - a. Press **MANUAL** to set the source power to the next measurement point listed in Table 2-4. The sweep indicator moves to the last measurement point on the sweep. (The sweep indicator indicates the last measurement point on the sweep, not the current point.)
  - b. Wait for the power meter reading to settle.
  - c. Record the power meter reading in the calculation sheet.
9. Change the start and stop power of the 4395A as follows:.

#### Control Settings

Power Sweep  
 CW Frequency: 50 MHz  
 Start Power: –5 dBm  
 Stop Power: 15 dBm  
 Number of Points: 5  
 Trigger: Manual  
 Trigger Event: On Point

#### Key Strokes

**Sweep**, **SWEEP TYPE MENU**, **POWER SWEEP**  
**Source**, **CW FREQ**, **5**, **0**, **M/μ**  
**Start**, **-**, **5**, **x1**  
**Stop**, **1**, **5**, **x1**  
**Sweep**, **NUMBER of POINTS**, **5**, **x1**  
**Trigger**, **TRIGGER[xxx]**, **MANUAL**  
**Trigger**, **TRIGGER[xxx]**, **TRIG EVENT [ON SWEEP]**  
 (Then the softkey label changes to  
**TRIGGER [ON POINT]**)

10. Press **Trigger**, **SINGLE**, **TRIGGER: [MANUAL]**, **MANUAL** to start a power sweep and to set the 4395A power to the first sweep point of –5 dBm listed in Table 2-5. Table 2-5 lists test settings. Verify that the step attenuator is set to 50 dB.

**Table 2-5. Power Sweep Linearity Test Settings 2**

| 4395A<br>Source Power | Step Attenuator |
|-----------------------|-----------------|
| –5 dBm                | 50 dB           |
| 0 dBm                 | 50 dB           |
| 5 dBm                 | 50 dB           |
| 10 dBm                | 50 dB           |
| 15 dBm                | 50 dB           |

11. Wait for the power meter reading to settle.
12. Record the power meter reading in the calculation sheet (“Power Meter Reading” column).
13. Repeat the following steps until a power sweep completed.
  - a. Press **MANUAL** to set the source power to the next measurement point listed in Table 2-5. The sweep indicator moves to the last measurement point on the sweep. (The sweep indicator indicates the last measurement point on the sweep, not the current point.)

- b. Wait for the power meter reading to settle.
  - c. Record the power meter reading in the calculation sheet.
14. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.

## 5. HARMONICS/NON-HARMONIC SPURIOUS TEST (NA)

### Description

This test sets the 4395A RF OUT signal power to +10 dBm and uses a spectrum analyzer to measure the RF OUT signal's second, third and non harmonic spurious at several frequencies. The RF OUT signal frequency is set to values where harmonics and non-harmonic spurious are most likely to be observed.

### Specification

#### Spectral Purity Characteristics

##### Harmonics

@+10 dBm output ..... < -30 dBc

##### Non-harmonics spurious

@+10 dBm output ..... < -30 dBc

### Test Equipment

Spectrum Analyzer ..... 8566A/B

Type-N Cable, 61 cm ..... 11500B or part of 11851B

BNC cable, 122 cm ..... PN 8120-1840

### Procedure

1. Connect the test equipment as shown in Figure 2-6.

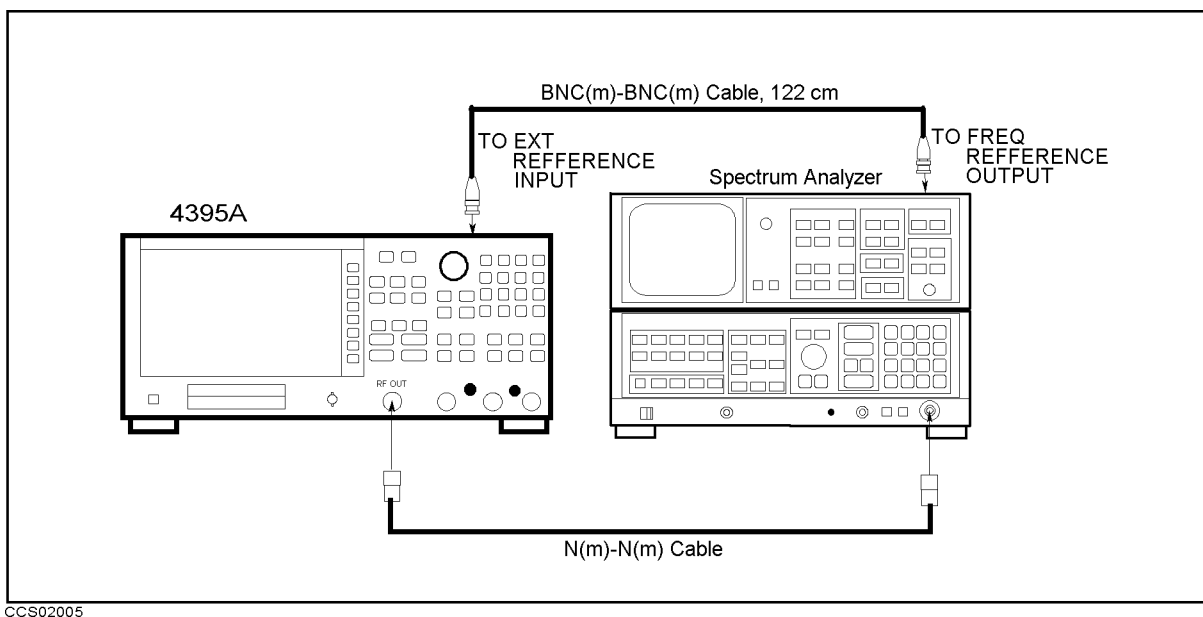


Figure 2-6. Harmonics Test Setup

**Note**

Connect the spectrum analyzer's 10 MHz frequency reference output to the 4395A EXT REF Input on the rear panel as shown in Figure 2-6. With this configuration, both the spectrum analyzer and the 4395A are phase locked to the same reference frequency to eliminate frequency offset errors.

2. Initialize the spectrum analyzer, and perform the FREQ ZERO calibration in accordance with the spectrum analyzer manual.

3. On the spectrum analyzer, set the controls as follows:

| Controls        | Settings |
|-----------------|----------|
| Reference Level | +10 dBm  |

4. Press **[Meas]**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

| Control Settings      | Key Strokes                                                            |
|-----------------------|------------------------------------------------------------------------|
| Frequency Span: 0 Hz  | <b>[Span]</b> , <b>ZERO SPAN</b>                                       |
| Source Power: +10 dBm | <b>[Source]</b> , <b>POWER</b> , <b>[1]</b> , <b>[0]</b> , <b>[x1]</b> |

5. —**Harmonics Test**—

- a. On the 4395A, press **[Center]**, **[1]**, **[0]**, **[k/m]** to set the center frequency to the first center frequency listed in the first column of Table 2-6. Table 2-6 lists test frequencies.

**Table 2-6. Harmonics Test Settings**

| 4395A<br>Center Frequency | Spectrum Analyzer          |                            |                   |       |
|---------------------------|----------------------------|----------------------------|-------------------|-------|
|                           | 2nd Harmonics<br>Frequency | 3rd Harmonics<br>Frequency | Frequency<br>Span | RBW   |
| 10 kHz                    | 20 kHz                     | 30 kHz                     | 1 kHz             | 30 Hz |
| 500 kHz                   | 1 MHz                      | 1.5 MHz                    | 1 kHz             | 30 Hz |
| 10 MHz                    | 20 MHz                     | 30 MHz                     | 1 kHz             | 30 Hz |
| 100 MHz                   | 200 MHz                    | 300 MHz                    | 1 kHz             | 30 Hz |
| 250 MHz                   | 500 MHz                    | 750 MHz                    | 1 kHz             | 30 Hz |
| 500 MHz                   | 1.0 GHz                    | 1.5 GHz                    | 1 kHz             | 30 Hz |

- b. On the spectrum analyzer, perform the following steps to measure the second and third harmonic level of the first test frequency 10 kHz.
  - i. Set the 8566A/B center frequency to the same value as the 4395A center frequency.
  - ii. Set the 8566A/B frequency span and RBW in accordance with Table 2-6.
  - iii. Press **[SINGLE]** to make a sweep. Wait for the completion of the sweep.
  - iv. Press **[PEAK SEARCH]**, **[Δ]** to move the marker to the peak of the fundamental signal and to place the delta marker reference at the peak.
  - v. Set the 8566A/B center frequency to the second harmonics frequency listed in the second column of Table 2-6.
  - vi. Press **[SINGLE]** to make a sweep. Wait for the completion of the sweep.
  - vii. Press **[PEAK SEARCH]** to move the marker to the peak of the second harmonic.
  - viii. Record the delta marker reading in the calculation sheet (“Delta Marker Reading” column).

- ix. Set the 8566A/B center frequency to the third harmonics frequency listed in the third column of Table 2-6.
  - x. Press **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - xi. Press **PEAK SEARCH** to move the marker to the peak of the third harmonic.
  - xii. Record the delta marker reading in the calculation sheet (“Delta Marker Reading” column).
- c. Change the measurement setting in accordance with Table 2-6 and repeat step 5-b for each frequency.
  - d. Calculate test results using the equation given in the calculation sheet.
6. —**Non-Harmonic Spurious Test**—
- a. On the spectrum analyzer, set the controls as follows:

| Controls        | Settings |
|-----------------|----------|
| Reference Level | +20 dBm  |

- b. On the 4395A, press **Center**, **1**, **0**, **x1** to set the center frequency to the first center frequency listed in the first column of Table 2-7. Table 2-7 lists test frequencies.

**Table 2-7. Non-Harmonics Test Settings**

| 4395A<br>Center Frequency | Spectrum Analyzer                   |                   |       |
|---------------------------|-------------------------------------|-------------------|-------|
|                           | Non-Harmonics Spurious<br>Frequency | Frequency<br>Span | RBW   |
| 10 Hz                     | 830.00001 MHz                       | 10 Hz             | 10 Hz |
| 230 MHz                   | 600 MHz                             | 1 kHz             | 30 Hz |
| 330 MHz                   | 500 MHz                             | 1 kHz             | 30 Hz |
| 430 MHz                   | 400 MHz                             | 1 kHz             | 30 Hz |
| 500 MHz                   | 330 MHz                             | 1 kHz             | 30 Hz |

- c. On the spectrum analyzer, perform the following steps to measure the non-harmonic spurious level of the first test frequency 10 Hz.
- d. Perform the following steps to test non-harmonics spurious of 4395A.
  - i. Set the 8566A/B center frequency to the same value as the 4395A center frequency.
  - ii. Set the 8566A/B frequency span and RBW in accordance with Table 2-7.
  - iii. Press **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - iv. Press **PEAK SEARCH**, **Δ** to move the marker to the peak of the fundamental signal and to place the delta maker reference at the peak.
  - v. Set the 8566A/B center frequency to the frequency listed in the second column of Table 2-7.
  - vi. Press **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - vii. Press **PEAK SEARCH** to move the marker to the peak of the non-harmonic spurious.
  - viii. Record the delta marker reading in the calculation sheet (“Delta Marker Reading” column).
- e. Change the measurement setting in accordance with Table 2-7 and repeat step 6-d for each frequency.
- f. Calculate test results using the equation given in the calculation sheet.

## 6. DC BIAS TEST (NA) (Option 001)

### Description

This test uses a multimeter to measure the actual DC bias voltage and current levels of the 4395A.

### Specification

#### DC Bias Level Accuracy

##### Voltage

@23±5°C .....  $\pm(0.1\% + 4\text{mV} + I_{dc}[\text{mA}]^1 \times 5[\Omega]\text{mV})$

##### Current

@23±5°C .....  $\pm(0.5\% + 30\mu\text{A} + V_{dc}^2[\text{V}]/10[\text{k}\Omega]\text{mA})$

1: Current at DC source connector

2: Voltage at DC source connector

### Test Equipment

Multimeter ..... 3458A  
BNC cable, 61 cm ..... PN 8120-1839  
N(m)-BNC(f) adapter ..... PN 1250-0780  
BNC(f)-Dual Banana Plug Adapter ..... PN 1251-2277

### Procedure

#### 1. DC Bias Voltage Level Test

- a. Connect the test equipment as shown in Figure 2-7.

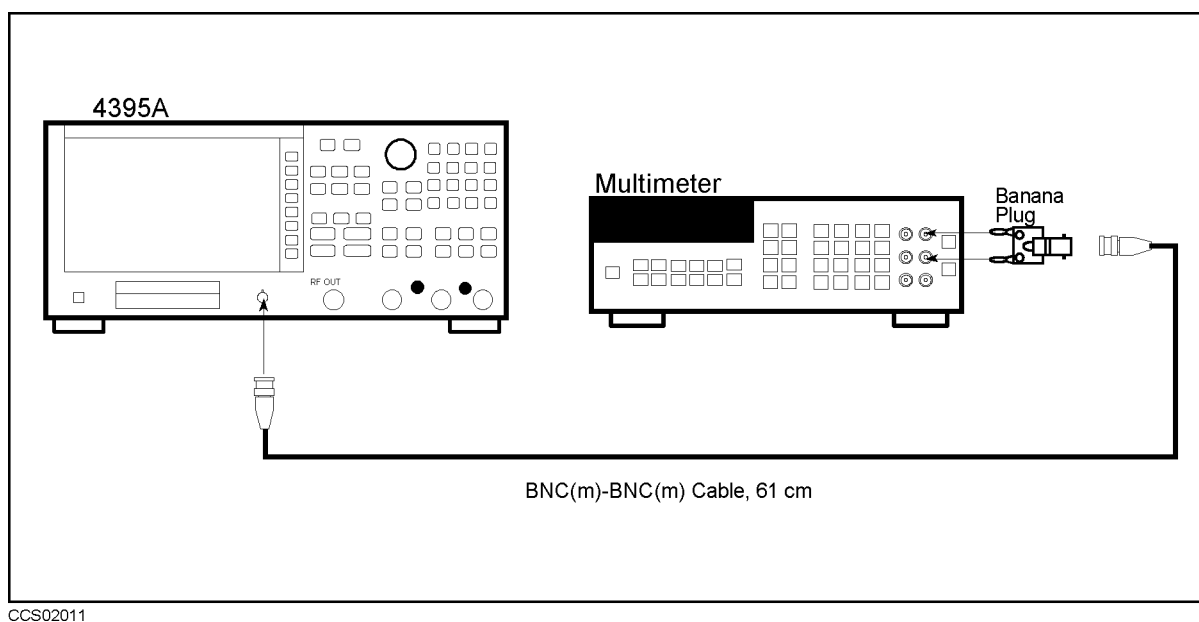


Figure 2-7. DC Bias Voltage Level Test Setup



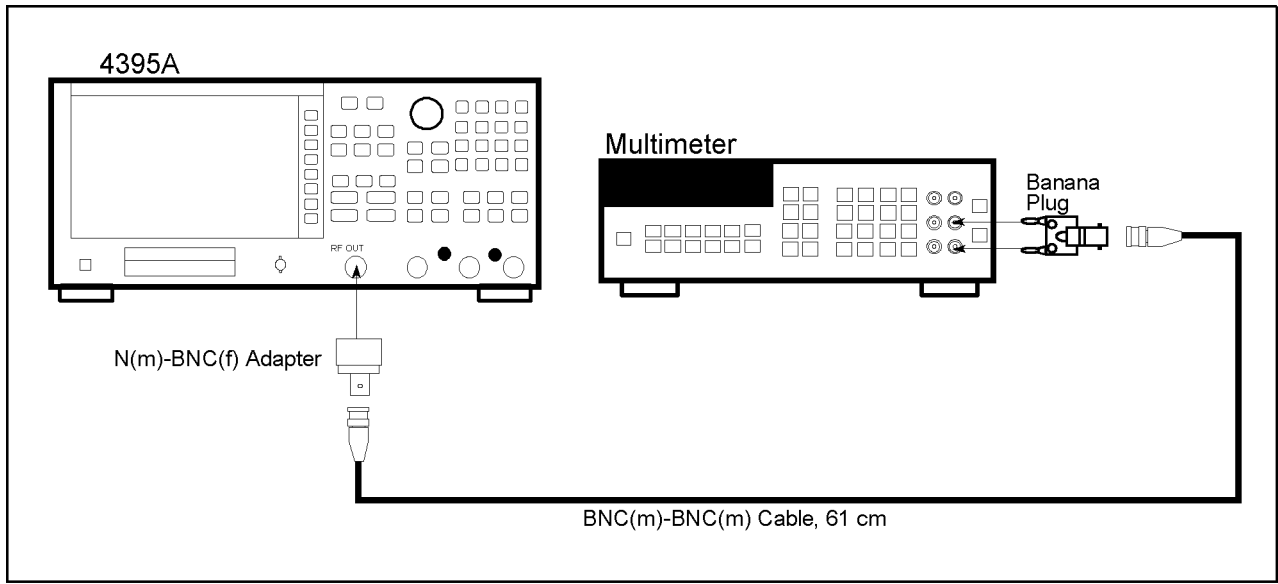
- b. Press **Meas**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **Preset** to initialize the 4395A.
- c. Initialize the multimeter. Then set the controls as follows:
 

| <b>Controls</b>       | <b>Settings</b> |
|-----------------------|-----------------|
| Measurement Function  | DC Volts Mode   |
| Display Reading Value | V Reading Value |
| Measurement Range     | Auto Range      |
| NPLC                  | 100             |
- d. Set the 4395A and the multimeter to the first column of Table 2-8

**Table 2-8. DC Bias Level Test Settings**

| <b>4395A<br/>DC Level</b> | <b>4395A<br/>DC Current Limit</b> | <b>Multimeter Range<br/>(Auto Range)</b> |
|---------------------------|-----------------------------------|------------------------------------------|
| –40 V                     | 100 mA                            | 100 V                                    |
| –10 V                     | 100 mA                            | 10 V                                     |
| –4 V                      | 100 mA                            | 10 V                                     |
| 0 V                       | 100 mA                            | 1 V                                      |
| 4 V                       | 100 mA                            | 10 V                                     |
| 10 V                      | 100 mA                            | 10 V                                     |
| 40 V                      | 100 mA                            | 100 V                                    |

- e. Wait for the multimeter reading to settle. Then record the reading in the calculation sheet (“Multimeter Reading” column).
  - f. Change the setting of the 4395A and the multimeter in accordance with Table 2-8 and repeat step 1-e for each setting.
  - g. Calculate test results using the equation given in the calculation sheet. Record the test results in the performance test record.
- 2. DC Bias Current Level Test**
- a. Connect the test equipment as shown in Figure 2-8.



**Figure 2-8. DC Bias Current Level Test Setup**

- b. Initialize the multimeter. Then set the controls as follows:

| Controls              | Settings        |
|-----------------------|-----------------|
| Measurement Function  | DC I Mode       |
| Display Reading Value | A Reading Value |
| Measurement Range     | Auto Range      |
| NPLC                  | 100             |

- c. Set the 4395A and the multimeter to the first column of Table 2-9

**Table 2-9. DC Bias Current Level Test Settings**

| 4395A<br>DC Level | 4395A<br>DC Voltage Limit | Multimeter Range<br>(Auto Range) |
|-------------------|---------------------------|----------------------------------|
| -100 mA           | 20 V                      | 100 mA                           |
| -10 mA            | 20 V                      | 10 mA                            |
| -1 mA             | 20 V                      | 1 mA                             |
| -20 $\mu$ A       | 20 V                      | 100 $\mu$ A                      |
| 20 $\mu$ A        | 20 V                      | 100 $\mu$ A                      |
| 1 mA              | 20 V                      | 1 mA                             |
| 10 mA             | 20 V                      | 10 mA                            |
| 100 mA            | 20 V                      | 100 mA                           |

- d. Wait for the multimeter reading to settle. Then record the reading in the calculation sheet ("Multimeter Reading" column).
- e. Change the setting of the 4395A and the multimeter in accordance with Table 2-9 and repeat step 2-d for each setting.
- f. Calculate test results using the equation given in the calculation sheet. Record the test results in the performance test record.

## 2-20 Performance Tests

# 7. RECEIVER NOISE LEVEL TEST (NA)

## Description

This test measures the 4395A receiver noise levels (noise floor) in the network analyzer mode at IF BW 10 Hz. This measures the noise level using the marker statistics function (mean) when the inputs are terminated.

In this test, the noise level (trace mean value) is measured in linear format [Unit]. Then the measured values are converted to log magnitude format [dBm]. This is done to avoid skewing the data with the marker statistics function.

## Specification

### Noise level

| Frequency                                 | Noise Level<br>@IFBW=10 Hz         |
|-------------------------------------------|------------------------------------|
| $100 \leq \text{freq.} < 100 \text{ kHz}$ | $< -85 \text{ dBm}$                |
| $100 \text{ kHz} \leq \text{freq.}$       | $< [ -115 + f^1/100 ] \text{ dBm}$ |

1:  $f$  is measurement frequency (MHz).

## Test Equipment

50Ω Termination (three required) ..... 909C Opt. 012 or part of 85032B

## Procedure

1. Connect the test equipment as shown in Figure 2-9.

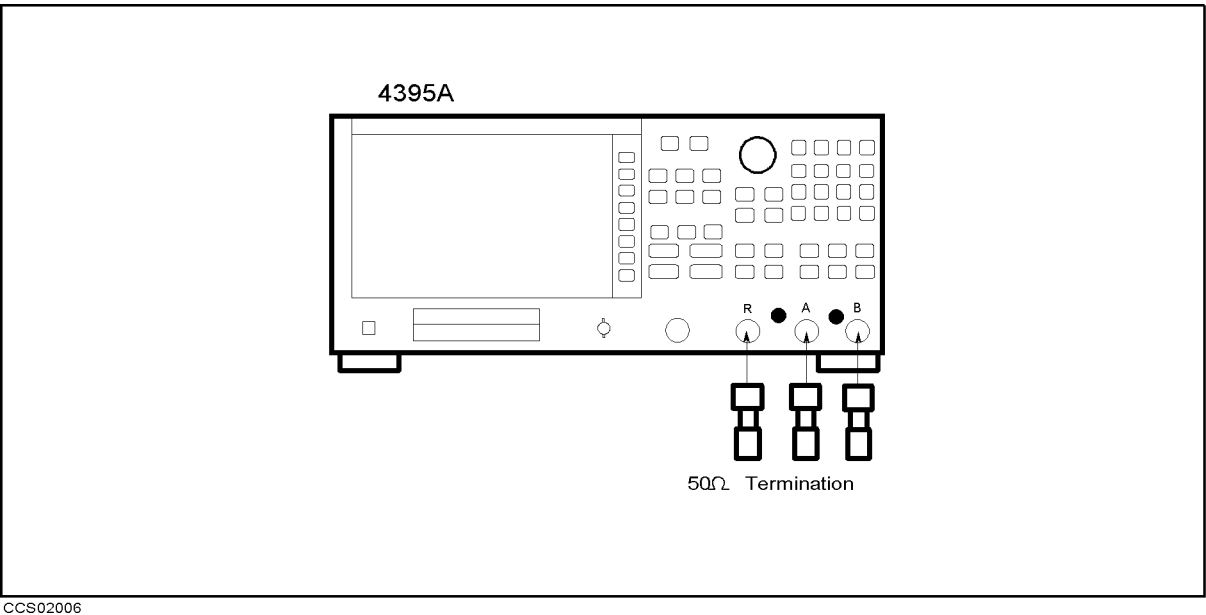


Figure 2-9. Receiver Noise Level Test Setup

2. Press **[Meas]**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

#### Control Settings

Input Port: R  
 Format: LINEAR  
 Scale/Division: 5  $\mu$ U  
 Input Attenuator R: 10 dB  
 Input Port: A  
 Format: LINEAR  
 Scale/Division: 5  $\mu$ U  
 Input Attenuator A: 10 dB  
 Input Port: B  
 Format: LINEAR  
 Scale/Division: 5  $\mu$ U  
 Input Attenuator B: 10 dB  
 Source Power: -50 dBm  
 Frequency Span: 0 Hz  
 IF BW: 10 Hz  
 Number of Points: 51  
 Statistics: ON

#### Key Strokes

**[Meas]**, R  
**[Format]**, LIN MAG  
**[Scale Ref]**, SCALE/DIV, 5, **[M/ $\mu$ ]**  
**[Scale Ref]**, ATTENUATOR MENU, ATTEN R, 1, 0, **[x1]**  
**[Meas]**, A  
**[Format]**, LIN MAG  
**[Scale Ref]**, SCALE/DIV, 5, **[M/ $\mu$ ]**  
**[Scale Ref]**, ATTENUATOR MENU, ATTEN A, 1, 0, **[x1]**  
**[Meas]**, B  
**[Format]**, LIN MAG  
**[Scale Ref]**, SCALE/DIV, 5, **[M/ $\mu$ ]**  
**[Scale Ref]**, ATTENUATOR MENU, ATTEN B, 1, 0, **[x1]**  
**[Source]**, POWER, -, 5, 0, **[x1]**  
**[Span]**, ZERO SPAN  
**[Bw/Avg]**, IF BW, 1, 0, **[x1]**  
**[Sweep]**, NUMBER of POINTS 5, 1, **[x1]**  
**[Utility]**, STATISTICS on OFF (Then the softkey label changes to STATISTICS ON off.)

3. Press **[Center]**, 1, 0, 0, **[x1]** to set the 4395A center frequency to the first center frequency 100 kHz listed in Table 2-10.

**Table 2-10. Receiver Noise Test Settings**

| 4395A<br>Center Frequency |
|---------------------------|
| 100 Hz                    |
| 1 kHz                     |
| 10 kHz                    |
| 100 kHz                   |
| 1 MHz                     |
| 11 MHz                    |
| 101 MHz                   |
| 499 MHz                   |

4. Perform the following steps to measure the receiver noise level.
  - a. Press **[Meas]**, R to set the 4395A input to R input.
  - b. Press **[Trigger]**, SINGLE to make a sweep. Wait for the completion of the sweep.

- c. Record the 4395A trace mean value [Unit] in the calculation sheet (“Trace Mean” column). The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.
  - d. Press **Meas**, **A** to set the 4395A to A input.
  - e. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - f. Record the 4395A trace mean value [Unit] in the calculation sheet (“Trace Mean” column).
  - g. Press **Meas**, **B** to set the 4395A input to B input.
  - h. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - i. Record the 4395A trace mean value [Unit] in the calculation sheet (“Trace Mean” column).
5. Change the 4395A center frequency in accordance with Table 2-10, and repeat step 4 for each setting.
  6. Convert the unit of the test results from [Unit] to [dBm] using the equation given in the calculation sheet. Record the test results [dBm] in the performance test record.

## 8. INPUT CROSSTALK TEST (NA)

### Description

This test measures the crosstalk (signal leakage interference) between two inputs of the 4395A R, A, and B inputs when RF OUT signal is supplied to one input and the other is terminated.

### Specification

#### Input crosstalk

R to A, B(@R port att.=20 dB, 10 dBm input, A & B port att.=0 dB)

freq. < 100 kHz ..... < -100 dB

freq. ≥ 100 kHz ..... < -120 dB

### Test Equipment

Type-N Cable, 61 cm ..... 11500B or part of 11851B

50Ω Termination (two required) ..... 909C Opt. 012 or part of 85032B

### Procedure

1. Connect the test equipment as shown in Figure 2-10.

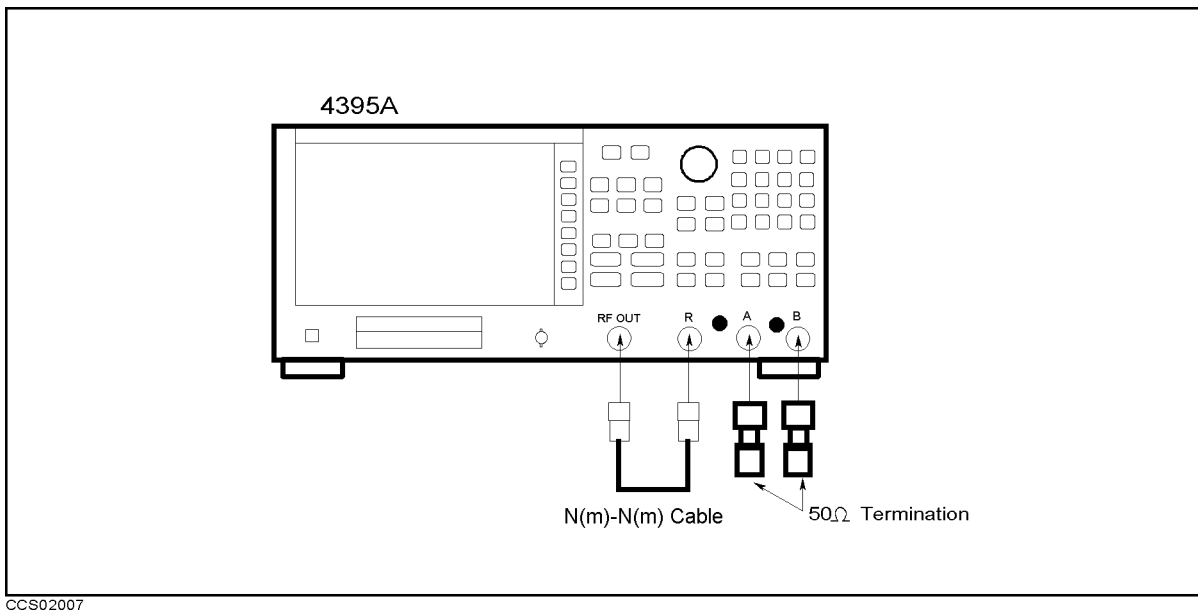


Figure 2-10. Input Crosstalk Test Setup

2. Press **Meas**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **Preset** to initialize the 4395A. Then set the controls as follows:

#### Control Settings

Dual Channel: On

#### Key Strokes

**Display**, **DUAL CHAN on OFF** (Then the softkey label changes to **DUAL CHAN ON off**).

Active Channel: CH 1      **Ch 1**  
Input Port: A/R      **Meas**, **A/R**  
Format: LOG MAG      **Format**, **LOG MAG**  
Reference Level: -100 dB      **Scale Ref**, **REFERENCE VALUE**, **-**, **1**, **0**, **0**, **x1**  
Active Channel: CH 2      **Ch 2**  
Input Port: B/R      **Meas**, **B/R**  
Format: LOG MAG      **Format**, **LOG MAG**  
Reference Level: -100 dB      **Scale Ref**, **REFERENCE VALUE**, **-**, **1**, **0**, **0**, **x1**  
Source Power: +10 dBm      **Source**, **POWER**, **1**, **0**, **x1**  
Input Attenuator R: 20dB      **Scale Ref**, **ATTENUATOR MENU**, **ATTEN R**, **2**, **0**, **x1**  
Input Attenuator A: 0dB      **Scale Ref**, **ATTENUATOR MENU**, **ATTEN A**, **0**, **x1**  
Input Attenuator B: 0dB      **Scale Ref**, **ATTENUATOR MENU**, **ATTEN B**, **0**, **x1**

3. Press **Start**, **1**, **0**, **x1** to set the start frequency to the first test setting 10 Hz listed in Table 2-11
4. Press **Stop**, **1**, **k/m** to set the stop frequency to the first test setting 10 kHz listed in Table 2-11
5. Press **Bw/Avg**, **IF BW**, **2**, **x1** to set the IF Bandwidth to the first test setting 2 Hz listed in Table 2-11
6. Press **Sweep**, **NUMBER of POINTS**, **1**, **1**, **x1** to set the number of points to the first test setting 11 listed in Table 2-11

**Table 2-11. Input Crosstalk Test Test Settings**

| Start Frequency | Stop Frequency | IF BW | Number of Points |
|-----------------|----------------|-------|------------------|
| 10 Hz           | 1 kHz          | 2 Hz  | 11               |
| 1 kHz           | 100 kHz        | 30 Hz | 101              |
| 100 kHz         | 500 MHz        | 30 Hz | 201              |

7. Perform the following steps to test the input crosstalk of the 4395A.
  - a. Press **Sweep**, **COUPLED CH on OFF**
  - b. Press **Ch1**, **Trigger**, **SINGLE** to make a sweep on channel 1. Wait for the completion of the sweep.
  - c. Press **Search**, **MAX** to move the channel 1 marker to the maximum point on the trace (A/R).
  - d. Record the marker reading in the calculation sheet (“Maker Reading” column for R into A crosstalk).
  - e. Press **Ch2**, **Trigger**, **SINGLE** to make a sweep on channel 2. Wait for the completion of the sweep.
  - f. Press **Search**, **MAX** to move the channel 2 marker to the maximum point on the trace (B/R).
  - g. Record the marker reading in the calculation sheet (“Maker Reading” column for R into B crosstalk).

8. Press **Sweep**, **COUPLED CH ON off**, change the 4395A test settings in accordance with the Table 2-11, and repeat step 7 for each setting.



---

## 9. INPUT IMPEDANCE TEST (NA)

### Description

This test uses a network analyzer and a T/R test set to measure the return losses of the 4395A R, A, and B inputs. One-port full calibration is performed to measured the return loss accurately.

The 4395A has no capability for making an A/B measurement. The 4395A can measure the return loss of the B (or A) input using A/R (or B/R) measurement capability of the 4395A. However, it cannot measure the R input's return loss. Therefore, a network analyzer is used in this test.

### Specification

#### Return Loss (@att.=10 dB)

| Frequency                 | Return Loss<br>@att.=10 dB |
|---------------------------|----------------------------|
| 100 kHz ≤ freq. ≤ 100 MHz | ≥25 dB                     |
| 100 MHz < freq.           | ≥15 dB                     |

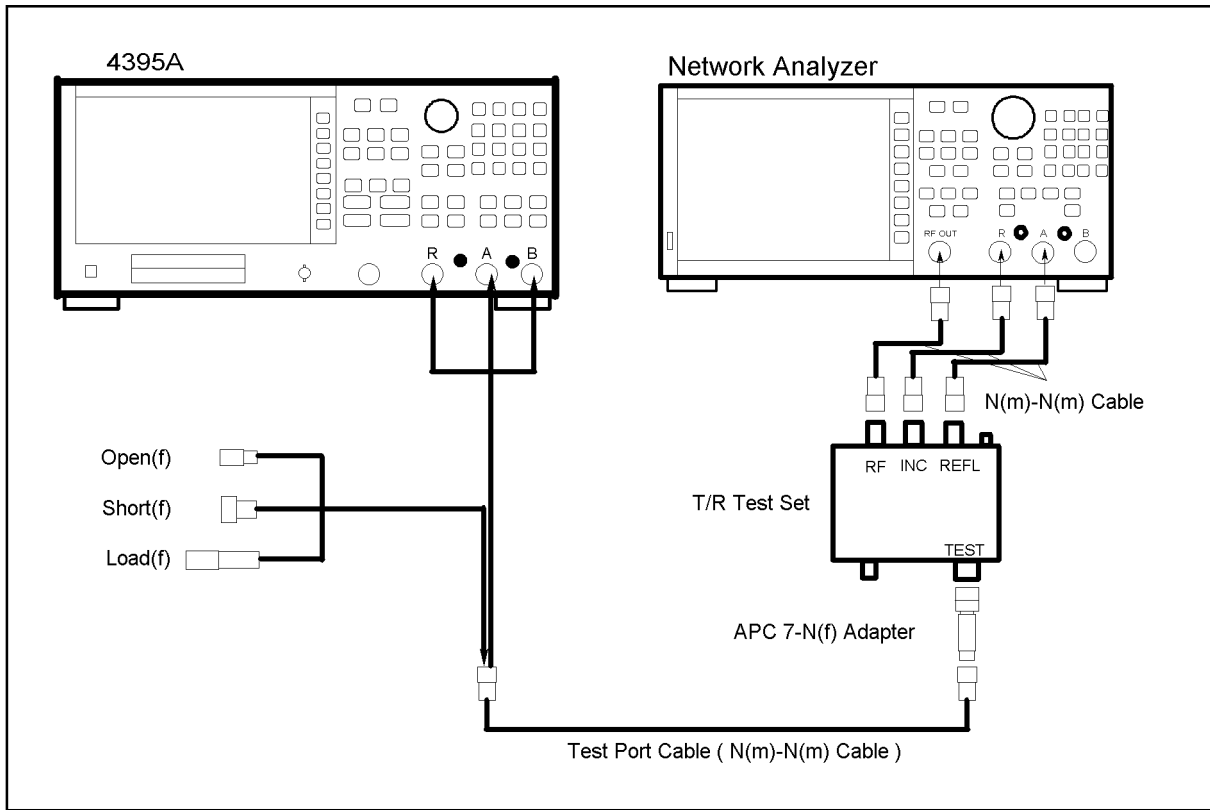
### Test Equipment

|                                           |                          |
|-------------------------------------------|--------------------------|
| Network Analyzer .....                    | 8753A/B/C                |
| T/R Test Sets .....                       | 85044A                   |
| 50Ω Type-N Calibration Kit .....          | 85032B <sup>1</sup>      |
| APC7.5-N(f) adapter .....                 | 11524A or part of 85032B |
| Type-N Cable, 61 cm (four required) ..... | 11500B or part of 11851B |

1: This calibration kit includes several terminations and adapters. This test requires the OPEN(f), SHORT(f), LOAD(f) in the calibration kit 85032B.

### Procedure

1. Connect the test equipment as shown in Figure 2-11. Don't connect anything to the end of the test port cable.



CCS02030

**Figure 2-11. Impedance Test Setup**

2. Press **[Meas]**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Input Attenuator R: 10dB

Input Attenuator A: 10dB

Input Attenuator B: 10dB

**Key Strokes**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN R**, **[1]**, **[0]**, **[x1]**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN A**, **[1]**, **[0]**, **[x1]**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN B**, **[1]**, **[0]**, **[x1]**

3. On the network analyzer, perform the following steps to set the network analyzer controls to measure the return loss from 300 kHz to 100 MHz.
  - a. Press **[Preset]** to initialize the network analyzer.
  - b. Press **[Start]**, **[3]**, **[0]**, **[0]**, **[k/m]**.
  - c. Press **[Stop]**, **[1]**, **[0]**, **[0]**, **[M/μ]**.
  - d. Press **[Menu]**, **SWEEP TYPE MENU**, **LOG FREQ**.
  - e. Press **[Avg]**, **IF BW**, **[1]**, **[0]**, **[0]**, **[x1]**.
  - f. Press **[CAL]**, **CAL KIT [7mm]**, **N 50Ω**, **RETURN**, **CALIBRATION MENU**, **S11 1-PORT** to initiate a calibration.
  - g. Connect a type N(f) open to the end of the test port cable.
  - h. Press **(S11):OPENS**, **OPEN (M)**. Wait until a beep sounds. Then press **DONE:OPENS**.
  - i. Remove the open from the test port cable and connect a type N(f) short to the test port cable.

- j. Press **SHORTS**, **SHORT (M)**. Wait until a beep sounds. Then press **DONE:SHORTS**.
  - k. Remove the short from the test port cable and connect a type N(f) 50  $\Omega$  load to the test port cable.
  - l. Press **LOAD**. Wait until a beep sounds.
  - m. Press **DONE:1-PORT CAL** to complete the calibration sequence.
  - n. Remove the type N(f) 50  $\Omega$  load from the test port cable
4. Connect the test port cable to the 4395A R input.
  5. On the network analyzer, press **MENU**, **TRIGGER MENU**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  6. On the network analyzer, press **MKR FCTN**, **MKR SEARCH [OFF]**, **MAX** to move the marker to the maximum point on the trace.
  7. Record the network analyzer's marker reading (with an opposite sign) in the performance test record ("Test Result" column).
  8. Remove the test port cable from the 4395A R input and connect it to the A input.
  9. On the network analyzer, press **MENU**, **TRIGGER MENU**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  10. On the network analyzer, press **MKR FCTN**, **MKR SEARCH [OFF]**, **MAX** to move the marker to the maximum point on the trace.
  11. Record the network analyzer's marker reading (with an opposite sign) in the performance test record ("Test Result" column).
  12. Remove the test port cable from the 4395A A input and connect it to the B input.
  13. On the network analyzer, press **MENU**, **TRIGGER MENU**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  14. On the network analyzer, press **MKR FCTN**, **MKR SEARCH [OFF]**, **MAX** to move the marker to the maximum point on the trace.
  15. Record the network analyzer's marker reading (with an opposite sign) in the performance test record ("Test Result" column).
  16. On the network analyzer, perform the following steps to set the network analyzer controls to measure the return loss from 100 MHz to 500 MHz.
    - a. Press **Preset** to initialize the network analyzer.
    - b. Press **Start**, **1**, **0**, **0**, **M/μ**.
    - c. Press **Stop**, **5**, **0**, **0**, **M/μ**.
    - d. Press **Menu**, **SWEEP TYPE MENU**, **LOG FREQ**
    - e. Press **Avg**, **IF BW**, **1**, **0**, **0**, **x1**.
    - f. Press **CAL**, **CAL KIT [7mm]**, **N 50Ω**, **RETURN**, **CALIBRATION MENU**, **S11 1-PORT** to initiate a calibration.
    - g. Connect a type N(f) open to the end of the test port cable.
    - h. Press **(S11):OPENS**, **OPEN (M)**. Wait until a beep sounds. Then press **DONE:OPENS**.
    - i. Remove the open from the test port cable and connect a type N(f) short to the test port cable.
    - j. Press **SHORTS**, **SHORT (M)**. Wait until a beep sounds. Then press **DONE:SHORTS**.

- k. Remove the short from the test port cable and connect a type N(f) 50  $\Omega$  load to the test port cable.
  - l. Press **LOAD**. Wait until a beep sounds.
  - m. Press **DONE:1-PORT CAL** to complete the calibration sequence.
  - n. Remove the type N(f) 50  $\Omega$  load from the test port cable
17. Connect the test port cable to the 4395A R input.
  18. On the network analyzer, press **MENU**, **TRIGGER MENU**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  19. On the network analyzer, press **MKR FCTN**, **MKR SEARCH [OFF]**, **MAX** to move the marker to the maximum point on the trace.
  20. Record the network analyzer's marker reading (with an opposite sign) in the performance test record ("Test Result" column).
  21. Remove the test port cable from the 4395A R input and connect it to the A input.
  22. On the network analyzer, press **MENU**, **TRIGGER MENU**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  23. On the network analyzer, press **MKR FCTN**, **MKR SEARCH [OFF]**, **MAX** to move the marker to the maximum point on the trace.
  24. Record the network analyzer's marker reading (with an opposite sign) in the performance test record ("Test Result" column).
  25. Remove the test port cable from the 4395A A input and connect it to the B input.
  26. On the network analyzer, press **MENU**, **TRIGGER MENU**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  27. On the network analyzer, press **MKR FCTN**, **MKR SEARCH [OFF]**, **MAX** to move the marker to the maximum point on the trace.
  28. Record the network analyzer's marker reading (with an opposite sign) in the performance test record ("Test Result" column).

---

## 10. ABSOLUTE AMPLITUDE ACCURACY TEST (NA)

### Description

This test measures a test signal amplitude using the 4395A absolute amplitude measurement function in the network analyzer mode and using a power meter, a power sensor and a multimeter. Then it compares the 4395A reading with the reading of the power meter or the multimeter. The accuracy of the absolute amplitude measurement is verified over the entire frequency range.

In this test, the 4395A RF OUT signal is used as the test signal. The RF OUT signal is divided through a two-way power splitter and applied to an 4395A input and the power sensor input or the multimeter.

### Specification

#### Absolute amplitude accuracy (R, A, B)

@-10 dBm input, input att. = 10 dB,  $23\pm5^{\circ}\text{C}$

freq.  $\geq 100\text{ Hz}$ , IFBW  $\leq 3\text{ kHz}$  .....  $<\pm 1.5\text{ dB}$

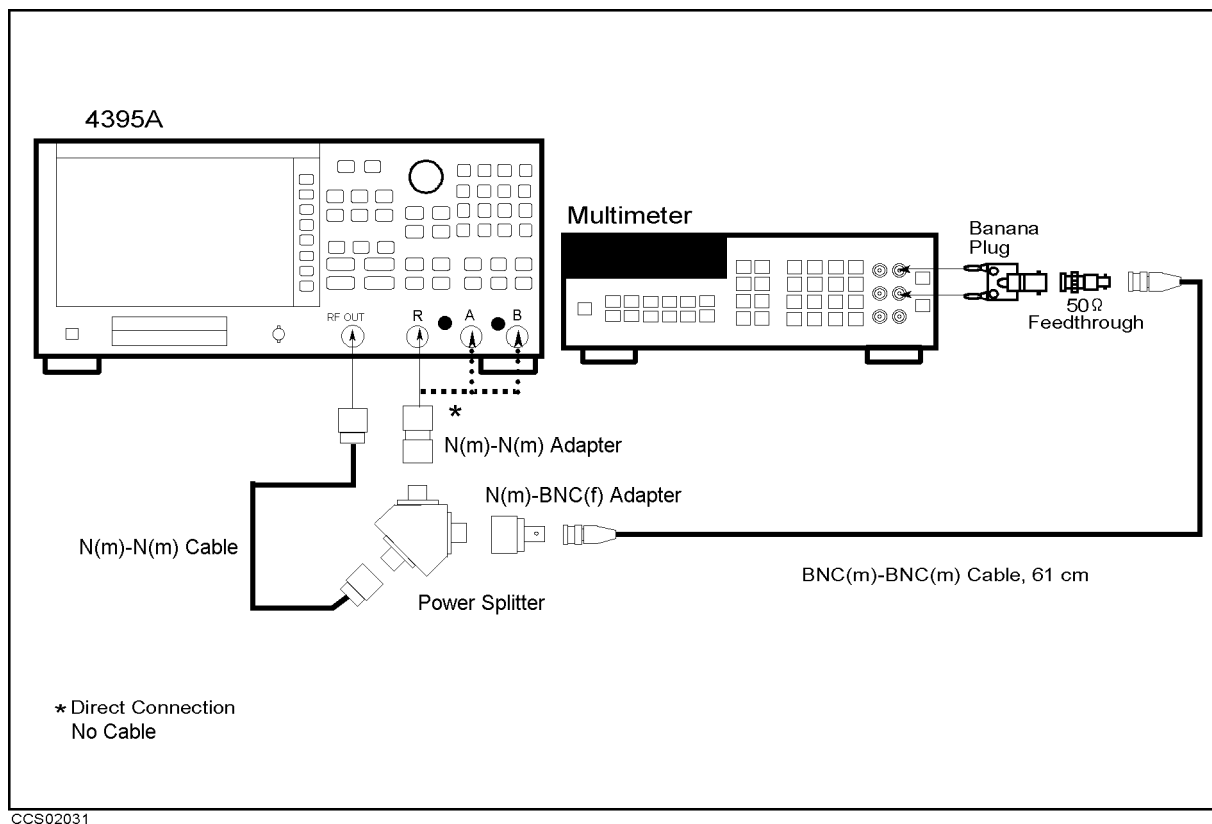
### Test Equipment

|                                       |                              |
|---------------------------------------|------------------------------|
| Power Meter .....                     | 436A Opt. 022, 437B, or 438A |
| Power Sensor .....                    | 8482A                        |
| Multimeter .....                      | 3458A                        |
| Two-Way Power Splitter .....          | 11667A                       |
| 50 $\Omega$ Feedthrough .....         | PN 04192-61002               |
| Type-N Cable, 61 cm .....             | 11500B or part of 11851B     |
| BNC cable, 61 cm .....                | PN 8120-1839                 |
| N(m)-BNC(f) adapter .....             | PN 1250-0780                 |
| N(m)-N(m) adapter .....               | PN 1250-1475                 |
| BNC(f)-Dual Banana Plug Adapter ..... | PN 1251-2277                 |

### Procedure

#### 1. For testing low frequencies

- Connect the test equipment as shown in Figure 2-12.



**Figure 2-12. Absolute Amplitude Accuracy Test Setup 1**

b. Initialize the multimeter. Then set the controls as follows:

**Controls**

Measurement Function  
Display Reading Value  
Measurement Method  
NPLC

**Settings**

AC Volts Mode  
dBm Reading Value  
Synchronous Sampling Conversion  
100

c. Press **[Meas]**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Source Power: -4 dBm  
Input Attenuator R: 10dB  
Input Attenuator A: 10dB  
Input Attenuator B: 10dB  
Number of Points: 11  
Frequency Span: 0 Hz  
Statistics: ON

**Key Strokes**

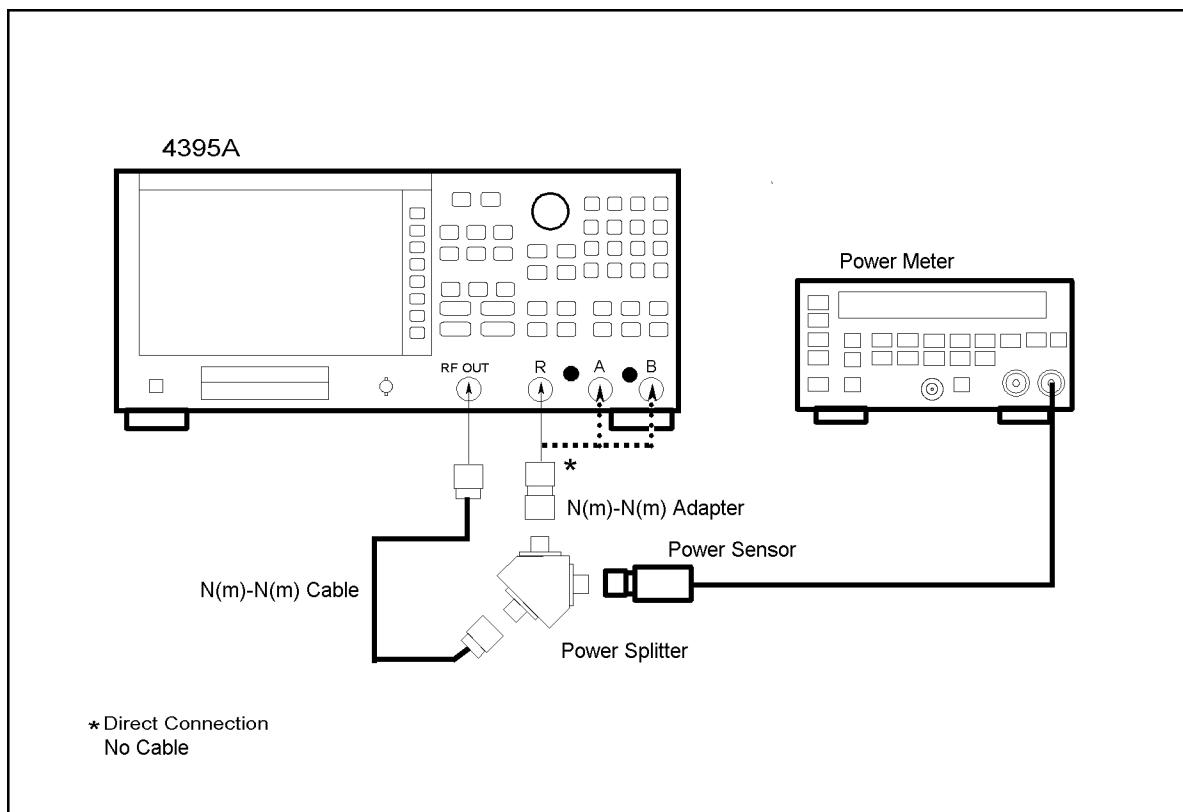
**[Source]**, **POWER**, **[-]**, **[4]**, **[x1]**  
**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN R**, **[1]**, **[0]**,  
**[x1]**  
**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN A**, **[1]**, **[0]**,  
**[x1]**  
**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN B**, **[1]**, **[0]**,  
**[x1]**  
**[Sweep]**, **NUMBER of POINTS**, **[1]**, **[1]**, **[x1]**  
**[Span]**, **ZERO SPAN**  
**[Utility]**, **STATISTICS on OFF** (Then the softkey  
label changes to **STATISTICS ON off**.)

- d. Press **Meas**, **R** to set the 4395A to the R input.
- e. Perform the following steps to test the absolute amplitude accuracy at the R input.
  - i. Press **Center**, **1**, **0**, **0**, **x1** to set the 4395A center frequency to the first test frequency 100 kHz listed in Table 2-12. Table 2-12 lists test frequencies.
  - ii. Press **Bw/Avg**, **IF BW**, **1**, **0**, **x1** to set the 4395A IF Bandwidth to the first test IF Bandwidth 10 Hz listed in Table 2-12.

**Table 2-12. Absolute Amplitude Accuracy Test Settings 1**

| 4395A<br>Center Frequency | IF BW  |
|---------------------------|--------|
| 100 Hz                    | 10 Hz  |
| 200 Hz                    | 10 Hz  |
| 500 Hz                    | 10 Hz  |
| 1 kHz                     | 100 Hz |
| 2 kHz                     | 100 Hz |
| 5 kHz                     | 100 Hz |
| 10 kHz                    | 100 Hz |
| 20 kHz                    | 100 Hz |
| 50 kHz                    | 100 Hz |
| 100 kHz                   | 100 Hz |
| 200 kHz                   | 100 Hz |
| 500 kHz                   | 100 Hz |

- iii. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - iv. Record the trace mean value and the multimeter reading in the calculation sheet (“4395A Reading” column and “Meter Reading” column, respectively). The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.
  - v. Change the 4395A center frequency and IF Bandwidth in accordance with Table 2-12, and repeat steps 1-e-iii and 1-e-iv for each center frequency.
  - f. Remove the power splitter from the R input, and connect it directly to the A input.
  - g. Press **Meas**, **A** to set the 4395A to the A input.
  - h. Repeat step 1-e to test the absolute amplitude accuracy at the 4395A A input.
  - i. Remove the power splitter from the A input, and connect it directly to the B input.
  - j. Press **Meas**, **B** to set the 4395A to the B input.
  - k. Repeat step 1-e to test the absolute amplitude accuracy at the B input.
  - l. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.
- 2. For testing high frequencies**
- a. Connect the power sensor to the power meter. Calibrate the power meter for the power sensor.
  - b. Connect the test equipment as shown in Figure 2-13.



**Figure 2-13. Absolute Amplitude Accuracy Test Setup 2**

- c. Press **Meas**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **Preset** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Source Power: -4 dBm

IF BW: 100 Hz

Input Attenuator R: 10dB

Input Attenuator A: 10dB

Input Attenuator B: 10dB

Number of Points: 11

Frequency Span: 0 Hz

Statistics: ON

**Key Strokes**

**Source**, **POWER**, **-**, **4**, **x1**

**Bw/Avg**, **IF BW**, **1**, **0**, **0**, **x1**

**Scale Ref**, **ATTENUATOR MENU**, **ATTEN R**, **1**, **0**, **x1**

**Scale Ref**, **ATTENUATOR MENU**, **ATTEN A**, **1**, **0**, **x1**

**Scale Ref**, **ATTENUATOR MENU**, **ATTEN B**, **1**, **0**, **x1**

**Sweep**, **NUMBER of POINTS**, **1**, **1**, **x1**

**Span**, **ZERO SPAN**

**Utility**, **STATISTICS on OFF** (Then the softkey label changes to **STATISTICS ON off**.)

- d. Press **Meas**, **R** to set the 4395A to the R input.

- e. Perform the following steps to test the absolute amplitude accuracy at the R input.



- i. Press **Center**, **1**, **M/μ** to set the 4395A center frequency to the first test frequency 1 MHz listed in Table 2-13. Table 2-13 lists test frequencies.

**Table 2-13. Absolute Amplitude Accuracy Test Settings 2**

| 4395A<br>Center Frequency |
|---------------------------|
| 1 MHz                     |
| 2 MHz                     |
| 5 MHz                     |
| 8 MHz                     |
| 10 MHz                    |
| 20 MHz                    |
| 50 MHz                    |
| 100 MHz                   |
| 125 MHz                   |
| 175 MHz                   |
| 200 MHz                   |
| 225 MHz                   |
| 275 MHz                   |
| 300 MHz                   |
| 325 MHz                   |
| 375 MHz                   |
| 400 MHz                   |
| 425 MHz                   |
| 475 MHz                   |
| 500 MHz                   |

- ii. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - iii. Record the trace mean value and the power meter reading in the calculation sheet (“4395A Reading” column and “Meter Reading” column, respectively). The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.
  - iv. Change the 4395A center frequency in accordance with Table 2-13, and repeat steps 2-e-ii. and 2-e-iii. for each center frequency.
- f. Remove the power splitter from the R input, and connect it directly to the A input.
  - g. Press **Meas**, **A** to set the 4395A to the A input.
  - h. Repeat step 2-e to test the absolute amplitude accuracy at the 4395A A input.
  - i. Remove the power splitter from the A input, and connect it directly to the B input.
  - j. Press **Meas**, **B** to set the 4395A to the B input.
  - k. Repeat step 2-e to test the absolute amplitude accuracy at the B input.
  - l. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.

---

## 11. MAGNITUDE RATIO/PHASE DYNAMIC ACCURACY TEST (NA)

### Description

Dynamic accuracy is a measure of how well a receiver measures the magnitude and phase components of a signal as that signal varies in amplitude over a specified dynamic range.

To measure the dynamic accuracy, this test applies a fixed level signal of  $-20$  dBm to the 4395A R input (reference input). At the same time, it applies a signal that varies from  $-10$  dBm (full scale input level) to  $-110$  dBm to one of the 4395A's A or B inputs (test input). It then measures the magnitude ratio from  $-10$  dB to  $-100$  dB and the phase of the signals.

The signal amplitude at the test input is varied by inserting known attenuation values. The measured magnitude ratio values are then compared to the inserted attenuation's calibrated values.

The phase dynamic accuracy is measured at 3 MHz (where the phase error contribution by the individual attenuator segments is small when compared to the test limits).

In this test, a step attenuator with its VSWR  $\leq 1.02$  and two 6 dB fixed attenuators with a VSWR  $\leq 1.015$  are used. Using these attenuators reduces the measurement uncertainties caused by mismatch error. When they are used, the measurement uncertainties listed in the performance test record are valid.

### Specification

#### Magnitude ratio/phase dynamic accuracy (A/R, B/R)

| Input Level<br>(relative to full scale input level $-10$ dB) | Magnitude Ratio Dynamic<br>Accuracy <sup>1</sup> | Phase Dynamic Accuracy <sup>1</sup> |
|--------------------------------------------------------------|--------------------------------------------------|-------------------------------------|
| $0 \text{ dB} \geq \text{Input Level} > -10 \text{ dB}$      | $< \pm 0.4 \text{ dB}$                           | $< \pm 3 \text{ deg}$               |
| $-10 \text{ dB} \geq \text{Input Level} \geq -60 \text{ dB}$ | $< \pm 0.05 \text{ dB}$                          | $< \pm 0.3 \text{ deg}$             |
| $-60 \text{ dB} > \text{Input Level} \geq -80 \text{ dB}$    | $< \pm 0.3 \text{ dB}$                           | $< \pm 1.8 \text{ deg}$             |
| $-80 \text{ dB} > \text{Input Level} \geq -100 \text{ dB}$   | $< \pm 3 \text{ dB}$                             | $< \pm 18 \text{ deg}$              |

1: R input level (B input level for A/B) = full scale input level  $-10$  dB, IFBW = 10 Hz,  $23 \pm 5^\circ\text{C}$ ,  
At the following points, measurement error may exceed the specifications: 124.0 MHz, 136.0 MHz, 415.0 MHz

### Test Equipment

|                                                                   |                           |
|-------------------------------------------------------------------|---------------------------|
| Two-Way Power Splitter .....                                      | 11667A                    |
| Step Attenuator <sup>1</sup> , 10 dB Step, VSWR $\leq 1.02$ ..... | 8496G Opt. 001 and H60    |
| Attenuator driver .....                                           | 11713A                    |
| 6 dB Fixed Attenuation (two required) .....                       | 8491A Opt. 006            |
| 6 dB Fixed Attenuation, VSWR $\leq 1.015$ (two required) .....    | 8491A Opt. 006 & Opt. H60 |
| Type-N Cable, 61 cm (three required) .....                        | 11500B or part of 11851B  |
| N(m)-N(m) adapter .....                                           | PN 1250-1475              |

1: Calibration values for attenuation settings of 10 dB to 100 dB at 50 MHz are required.



### Control Settings

Source Power: -2 dBm

Active Channel: CH 1

Input Port: A/R

Format: LOG MAG

Averaging Factor: 4

Averaging: ON

Input Attenuator R: 0dB

Input Attenuator A: 0dB

Active Channel: CH 2

Input Port: A/R

Format: PHASE

Averaging Factor: 4

Averaging: ON

### Key Strokes

[Source], POWER, [-], [2], [x1]

[Ch 1]

[Meas], A/R

[Format], LOG MAG

[Bw/Avg], AVERAGING FACTOR, [4], [x1]

[Bw/Avg], AVERAGING on OFF (Then the softkey label changes to AVERAGING ON off.)

[Scale Ref], ATTENUATOR MENU, ATTEN R, [0], [x1]

[Scale Ref], ATTENUATOR MENU, ATTEN A, [0], [x1]

[Ch 2]

[Meas], A/R

[Format], PHASE

[Bw/Avg], AVERAGING FACTOR, [4], [x1]

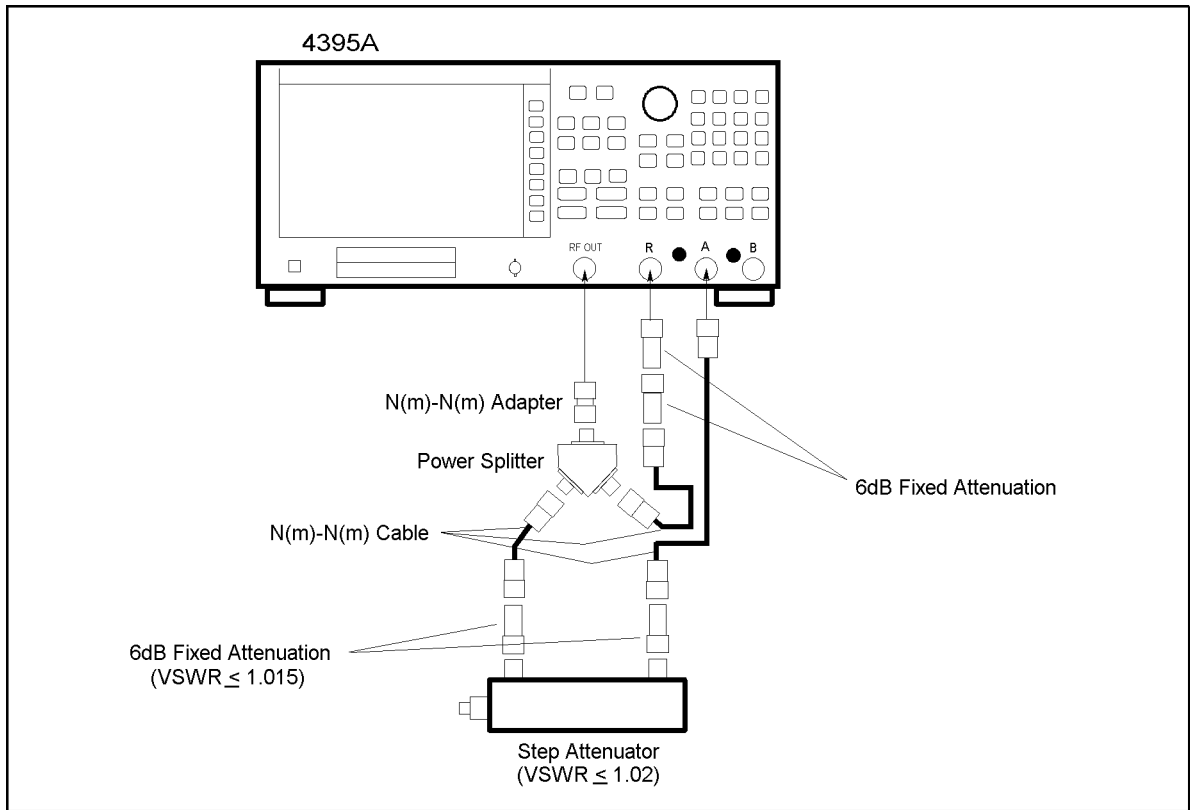
AVERAGING on OFF (Then the softkey label changes to AVERAGING ON off.)

- c. Set the step attenuator to 0 dB.
- d. Press [Cal], CALIBRATE MENU, RESPONSE, THRU to perform the response (THRU) calibration. Wait for the completion of the sweep. Then press DONE:RESPONSE.
- e. Set the step attenuator to the first setting 10 dB in the second column of Table 2-14.

**Table 2-14. A/R Dynamic Accuracy Test Settings 1**

| 4395A<br>Input Level | Step Attenuator | 4395A<br>Source Power |
|----------------------|-----------------|-----------------------|
| 0 dB                 | 10 dB           | 8 dBm                 |

- f. On the 4395A, press [Source], POWER, [8], [x1] to set the source power to the first setting in the third columns of Table 2-14.
- g. Perform the following steps to measure the dynamic accuracy.
  - i. Press [Trigger], NUMBER OF GROUPS, [5], [x1] to make a sweep. Wait for the completion of the sweep.
  - ii. Press [Marker], [↑] to move the channel 1 marker to 50.1 MHz.
  - iii. Record the channel 1 marker reading in the calculation sheet for the magnitude ratio dynamic accuracy. Use the 4395A reading column corresponding to the input level in the first column of Table 2-14.
  - iv. Press [↓] to move the channel 2 marker to 3 MHz.
  - v. Record the channel 2 marker reading directly in the performance test record. Use the test result column of the phase measurement corresponding to the input level in the first column of Table 2-14.
- h. Change the cable connection as shown in Figure 2-15.



**Figure 2-15. A/R Magnitude Ratio/Phase Dynamic Accuracy Test Setup 2**

- i. On the 4395A, set the controls as follows:

**Control Settings**

Source Power: 8 dBm

Active Channel: CH 1

Averaging Factor: 4

Active Channel: CH 2

Averaging Factor: 4

Input Attenuator R: 10dB

Input Attenuator A: 0dB

**Key Strokes**

[Source], POWER, [8], [x1]

[Ch 1]

[Bw/Avg], AVERAGING FACTOR, [4], [x1]

[Ch 2]

[Bw/Avg], AVERAGING FACTOR, [4], [x1]

[Scale Ref], ATTENUATOR MENU, ATTEN R, [1], [0], [x1]

[Scale Ref], ATTENUATOR MENU, ATTEN A, [0], [x1]

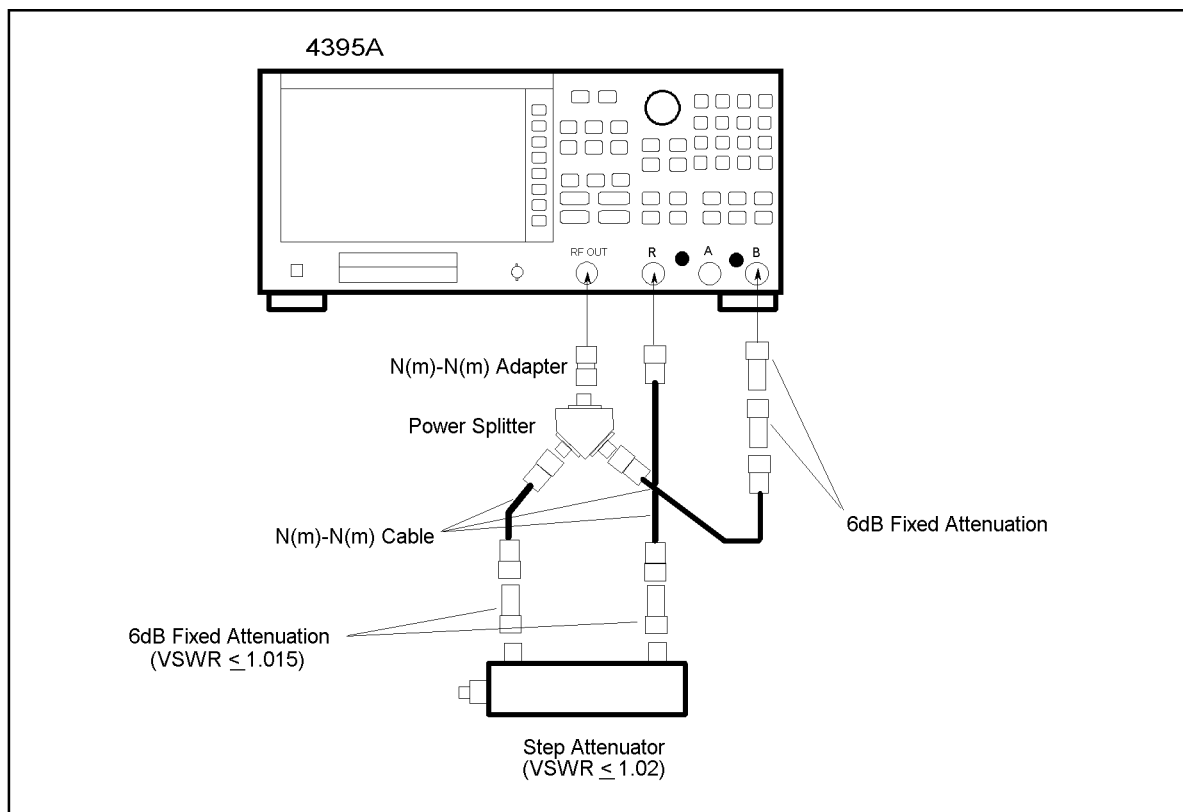
- j. Set the step attenuator to 10 dB.
- k. Press [Cal], CALIBRATE MENU, RESPONSE, THRU to perform the response (THRU) calibration. Wait for the completion of the sweep. Then press DONE:RESPONSE.

1. Set the step attenuator to the first setting 20dB in the second column of Table 2-15.

**Table 2-15. A/R Dynamic Accuracy Test Settings 2**

| 4395A<br>Input Level | Step Attenuator |
|----------------------|-----------------|
| −20 dB               | 20 dB           |
| −30 dB               | 30 dB           |
| −40 dB               | 40 dB           |
| −50 dB               | 50 dB           |
| −60 dB               | 60 dB           |
| −70 dB               | 70 dB           |
| −80 dB               | 80 dB           |
| −90 dB               | 90 dB           |
| −100 dB              | 100 dB          |

- m. Perform the following steps to measure the dynamic accuracy.
    - i. Press **Trigger**, **NUMBER OF GROUPS**, **5**, **x1** to make a sweep. Wait for the completion of the sweep.
    - ii. Press **Marker**, **↑** to move the channel 1 marker to 50.1 MHz.
    - iii. Record the channel 1 marker reading in the calculation sheet for the magnitude ratio dynamic accuracy. Use the 4395A reading column corresponding to the input level in the first column of Table 2-15.
    - iv. Press **↓** to move the channel 2 marker to 3 MHz.
    - v. Record the channel 2 marker reading directly in the performance test record. Use the test result column of the phase measurement corresponding to the input level in the first column of Table 2-15.
  - n. Change the step attenuator setting in accordance with the second column of Table 2-15, and perform step 3-m for each setting.
4. —**B/R Dynamic Accuracy Test (Magnitude Ratio at 50 MHz and Phase at 3 MHz)**—
- a. Connect the test equipment as shown in Figure 2-16.



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**Figure 2-16. B/R Magnitude Ratio/Phase Dynamic Accuracy Test Setup 1**

b. On the 4395A, set the controls as follows:

**Control Settings**

Source Power: -2 dBm

Active Channel: CH 1

Input Port: B/R

Format: LOG MAG

Averaging Factor: 4

Averaging: ON

Input Attenuator R: 0dB

Input Attenuator B: 0dB

Active Channel: CH 2

Input Port: B/R

Format: PHASE

Averaging Factor: 4

Averaging: ON

**Key Strokes**

[Source], POWER, [-], [2], [x1]

[Ch 1]

[Meas], B/R

[Format], LOG MAG

[Bw/Avg], AVERAGING FACTOR, [4], [x1]

[Bw/Avg], AVERAGING on OFF (Then the softkey label changes to AVERAGING ON off.)

[Scale Ref], ATTENUATOR MENU, ATTEN R, [0], [x1]

[Scale Ref], ATTENUATOR MENU, ATTEN B, [0], [x1]

[Ch 2]

[Meas], B/R

[Format], PHASE

[Bw/Avg], AVERAGING FACTOR, [4], [x1]

AVERAGING on OFF (Then the softkey label changes to AVERAGING ON off.)

c. Set the step attenuator to 0 dB.

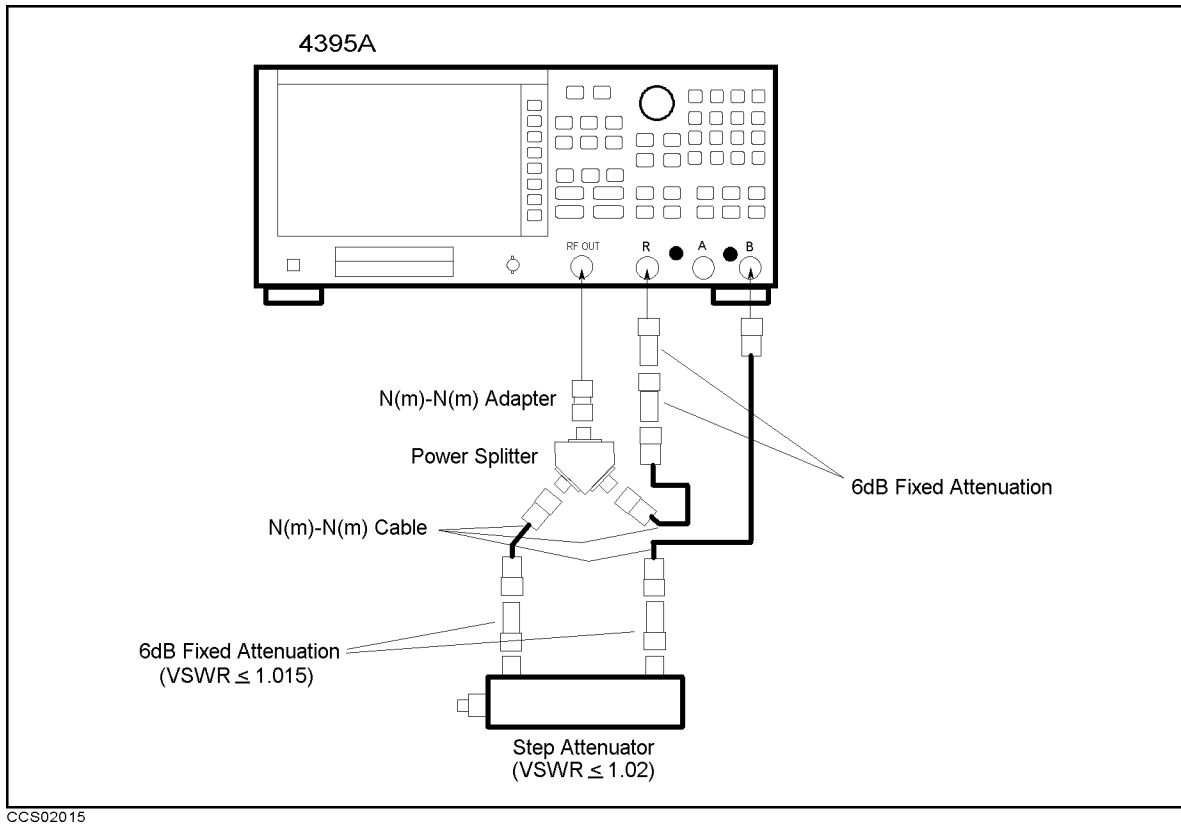
- d. Press **Cal**, **CALIBRATE MENU**, **RESPONSE**, **THRU** to perform the response (THRU) calibration. Wait for the completion of the sweep. Then press **DONE:RESPONSE**.
- e. Set the step attenuator to the first setting 10 dB in the second column of Table 2-16.

**Table 2-16. B/R Dynamic Accuracy Test Settings 1**

| 4395A<br>Input Level | Step Attenuator | 4395A<br>Source Power |
|----------------------|-----------------|-----------------------|
| 0 dB                 | 10 dB           | 8 dBm                 |

- f. On the 4395A, press **Source**, **POWER**, **8**, **x1** to set the source power to the first setting in the third columns of Table 2-14.
- g. Perform the following steps to measure the dynamic accuracy.
  - i. Press **Trigger**, **NUMBER OF GROUPS**, **5**, **x1** to make a sweep. Wait for the completion of the sweep.
  - ii. Press **Marker**, **↑** to move the channel 1 marker to 50.1 MHz.
  - iii. Record the channel 1 marker reading in the calculation sheet for the magnitude ratio dynamic accuracy. Use the 4395A reading column corresponding to the input level in the first column of Table 2-16.
  - iv. Press **↓** to move the channel 2 marker to 3 MHz.
  - v. Record the channel 2 marker reading directly in the performance test record. Use the test result column of the phase measurement corresponding to the input level in the first column of Table 2-16.
- h. Change the cable connection as shown in Figure 2-17.





**Figure 2-17. B/R Magnitude Ratio/Phase Dynamic Accuracy Test Setup 2**

- i. On the 4395A, set the controls as follows:

**Control Settings**

Source Power: 8 dBm

Active Channel: CH 1

Averaging Factor: 4

Active Channel: CH 2

Averaging Factor: 4

Input Attenuator R: 10dB

Input Attenuator B: 0dB

**Key Strokes**

**Source**, **POWER**, **8**, **x1**

**Ch 1**

**Bw/Avg**, **AVERAGING FACTOR**, **4**, **x1**

**Ch 2**

**Bw/Avg**, **AVERAGING FACTOR**, **4**, **x1**

**Scale Ref**, **ATTENUATOR MENU**, **ATTEN R**, **1**, **0**, **x1**

**Scale Ref**, **ATTENUATOR MENU**, **ATTEN B**, **0**, **x1**

- j. Set the step attenuator to 10 dB.
- k. Press **Cal**, **CALIBRATE MENU**, **RESPONSE**, **THRU** to perform the response (THRU) calibration. Wait for the completion of the sweep. Then press **DONE:RESPONSE**.
- l. Set the step attenuator to the first setting 20dB in the second column of Table 2-17.

**Table 2-17. B/R Dynamic Accuracy Test Settings 2**

| 4395A<br>Input Level | Step Attenuator |
|----------------------|-----------------|
| -20 dB               | 20 dB           |
| -30 dB               | 30 dB           |
| -40 dB               | 40 dB           |
| -50 dB               | 50 dB           |
| -60 dB               | 60 dB           |
| -70 dB               | 70 dB           |
| -80 dB               | 80 dB           |
| -90 dB               | 90 dB           |
| -100 dB              | 100 dB          |

- m. Perform the following steps to measure the dynamic accuracy.
- Press **Trigger**, **NUMBER OF GROUPS**, **5**, **x1** to make a sweep. Wait for the completion of the sweep.
  - Press **Marker**, **↑** to move the channel 1 marker to 50.1 MHz.
  - Record the channel 1 marker reading in the calculation sheet for the magnitude ratio dynamic accuracy. Use the 4395A reading column corresponding to the input level in the first column of Table 2-17.
  - Press **↓** to move the channel 2 marker to 3 MHz.
  - Record the channel 2 marker reading directly in the performance test record. Use the test result column of the phase measurement corresponding to the input level in the first column of Table 2-17.
- n. Change the step attenuator setting in accordance with the second column of Table 2-17, and perform step 4-m for each setting.

## 12. MAGNITUDE RATIO/PHASE FREQUENCY RESPONSE TEST (NA)

### Description

This test applies the RF OUT signal to the 4395A R input and either the A or B input through a power splitter. It then measures the magnitude ratio and phase of the A/R and B/R measurements. The magnitude ratio frequency response is measured as the deviation from the ideal magnitude ratio value of 0 dB. The phase frequency response is measured as the deviation from linear phase.

### Specification

#### Magnitude ratio accuracy (A/R, B/R)

@-10 dBm input, input att.= 10 dB, Freq.  $\geq 100$  Hz, IF BW  $\leq 3$  kHz,  $23 \pm 5^\circ\text{C}$  ..  $< \pm 2$  dB

#### Phase frequency response (Deviation from Linear Phase) (A/R, B/R)

@-10 dBm input, input att.= 10 dB, Freq.  $\geq 100$  Hz, IF BW  $\leq 3$  kHz,  $23 \pm 5^\circ\text{C}$  ...  $< \pm 12^\circ$

### Test Equipment

Two-Way Power Splitter ..... 11667A  
Type-N Cable, 61 cm (two required) ..... 11500B or part of 11851B  
N(m)-N(m) adapter ..... PN 1250-1475

### Procedure

1. Press **[Meas]**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

#### Control Settings

Statistics: ON

Dual Channel: On

Source Power: -4 dBm

IF BW: 1 kHz

Input Attenuator R: 10 dB

Input Attenuator A: 10 dB

Input Attenuator B: 10 dB

#### Key Strokes

**[Utility]**, **STATISTICS on OFF** (Then the softkey label changes to **STATISTICS ON off**.)

**[Display]**, **DUAL CHAN on OFF** (Then the softkey label changes to **DUAL CHAN ON off**.)

**[Source]**, **POWER**, **[-]**, **[4]**, **[x1]**

**[Bw/Avg]**, **IF BW**, **[1]**, **[k/m]**

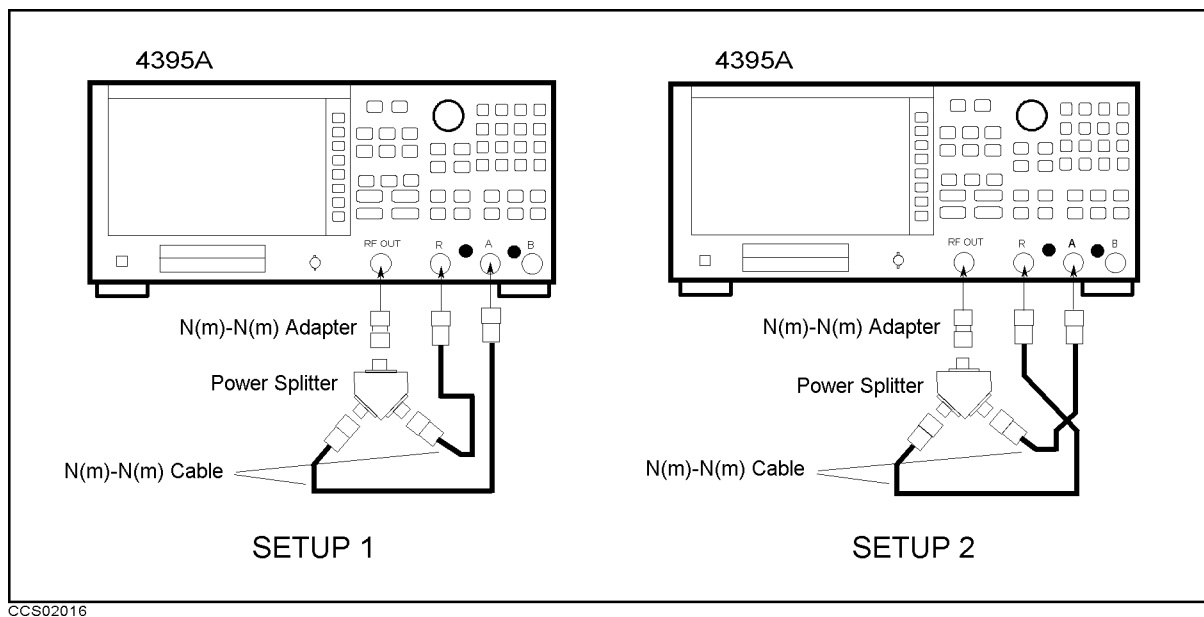
**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN R** **[1]**, **[0]**, **[x1]**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN A** **[1]**, **[0]**, **[x1]**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN B** **[1]**, **[0]**, **[x1]**

2. —A/R Magnitude Ratio/Phase Frequency Response Test—

- a. Connect the test equipment as shown in setup 1 of Figure 2-18.



**Figure 2-18. A/R Magnitude Ratio/Phase Frequency Response Test Setup**

- b. Set the 4395A controls as follows:

**Control Settings**

Active Channel: CH 1

Input Port: A/R

Format: LOG MAG

Active Channel: CH 2

Input Port: A/R

Format: PHASE

Start Frequency: 1 MHz

Stop Frequency: 500 MHz

Number of Points: 500

**Key Strokes**

**Ch 1**

**Meas**, **A/R**

**Format**, **LOG MAG**

**Ch 2**

**Meas**, **A/R**

**Format**, **PHASE**

**Start**, **1**, **M/μ**

**Stop**, **5**, **0**, **0**, **M/μ**

**Sweep**, **NUMBER of POINTS**, **5**, **0**, **0**, **x1**

- c. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.

- d. Set the 4395A controls as follows:

**Control Settings**

Active Channel: CH 1

Data→Memory

Active Channel: CH 2

Data→Memory

**Key Strokes**

**Ch 1**

**Display**, **DATA→MEMORY**

**Ch 2**

**Display**, **DATA→MEMORY**

- e. Reverse the cable connections of the 4395A A and R inputs as shown in setup 2 of Figure 2-18.

- f. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.

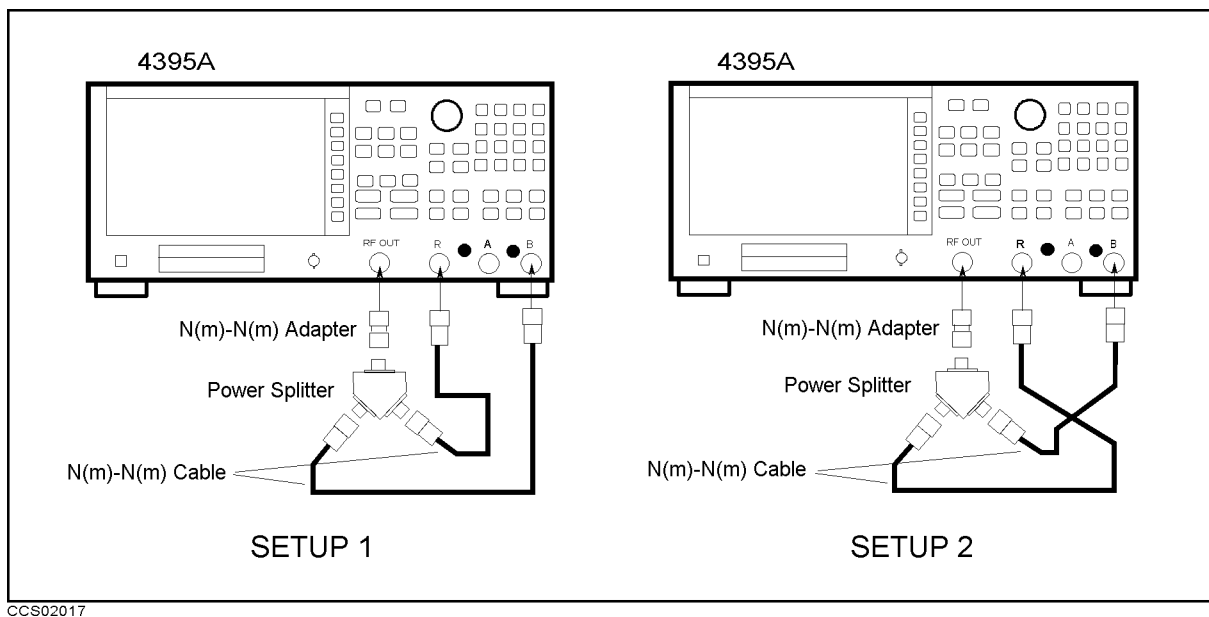
- g. Set the 4395A controls as follows:

**Control Settings**

**Key Strokes**

|                      |                                                                                                                |
|----------------------|----------------------------------------------------------------------------------------------------------------|
| Active Channel: CH 1 | <b>Ch 1</b>                                                                                                    |
| Data Math: DATA+MEM  | <b>Display</b> , <b>DATA MATH [xxx]</b> , <b>DATA+MEM</b> , <b>GAIN</b> , <b>[ ]</b> ,<br><b>5</b> , <b>x1</b> |
| Auto Scale           | <b>Scale Ref</b> , <b>AUTO SCALE</b>                                                                           |
| Active Channel: CH 2 | <b>Ch 2</b>                                                                                                    |
| Data Math: DATA+MEM  | <b>Display</b> , <b>DATA MATH [xxx]</b> , <b>DATA+MEM</b> , <b>GAIN</b> , <b>[ ]</b> ,<br><b>5</b> , <b>x1</b> |
| Auto Scale           | <b>Scale Ref</b> , <b>AUTO SCALE</b>                                                                           |

- h. Press **Ch 1**, **Search**, **MAX** and **Search**, **MIN** to move the channel 1 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.
  - i. Record the larger value in the performance test record (“Test Result” column for A/R magnitude ratio).
  - j. Press **Ch 2**, **Marker →**, **MKR→STOP**, **Cal**, **MORE**, **ELECTRICAL DELAY MENU**, **MKR→DELAY**, **ELECTRICAL DELAY**. Then press **↑** or **↓** and turn the RPG knob to vary the electrical delay until the trace is in the most horizontal position.
  - k. Press **PHASE OFFSET** and enter the trace mean value using numeric keys. The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.
  - l. Press **Search**, **MAX** and **Search**, **MIN** to move the channel 2 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.
  - m. Record the larger value in the performance test record (“Test Result” column for A/R phase).
- \* —B/R Magnitude Ratio/Phase Frequency Response Test—
- Connect the test equipment as shown in setup 1 of Figure 2-19.



**Figure 2-19. B/R Magnitude Ratio/Phase Frequency Response Test Setup**

- Set the 4395A controls as follows:

**Control Settings**

Active Channel: CH 1

Input Port: B/R

Format: LOG MAG

Active Channel: CH 2

Input Port: B/R

Format: PHASE

Start Frequency: 1 MHz

Stop Frequency: 500 MHz

Number of Points: 500

**Key Strokes**

**Ch 1**

**Meas**, B/R

**Format**, LOG MAG

**Ch 2**

**Meas**, B/R

**Format**, PHASE

**Start**, 1, M/μ

**Stop**, 5, 0, 0, M/μ

**Sweep**, NUMBER of POINTS, 5, 0, 0, x1

- Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.

- Set the 4395A controls as follows:

**Control Settings**

Active Channel: CH 1

Data→Memory

Active Channel: CH 2

Data→Memory

**Key Strokes**

**Ch 1**

**Display**, DATA→MEMORY

**Ch 2**

**Display**, DATA→MEMORY

- Reverse the cable connections of the 4395A A and R inputs as shown in setup 2 of Figure 2-18.

- Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.

- Set the 4395A controls as follows:

**Control Settings**

**Key Strokes**

|                      |                                                                                                   |
|----------------------|---------------------------------------------------------------------------------------------------|
| Active Channel: CH 1 | <b>Ch 1</b>                                                                                       |
| Data Math: DATA+MEM  | <b>Display</b> , <b>DATA MATH [xxx]</b> , <b>DATA+MEM</b> , <b>GAIN</b> , <b>[ ]</b> , <b>5</b> , |
|                      | <b>x1</b>                                                                                         |
| Auto Scale           | <b>Scale Ref</b> , <b>AUTO SCALE</b>                                                              |
| Active Channel: CH 2 | <b>Ch 2</b>                                                                                       |
| Data Math: DATA+MEM  | <b>Display</b> , <b>DATA MATH [xxx]</b> , <b>DATA+MEM</b> , <b>GAIN</b> , <b>[ ]</b> , <b>5</b> , |
|                      | <b>x1</b>                                                                                         |
| Auto Scale           | <b>Scale Ref</b> , <b>AUTO SCALE</b>                                                              |

- Press **Ch 1**, **Search**, **MAX** and **Search**, **MIN** to move the channel 1 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.
- Record the larger value in the performance test record (“Test Result” column for A/R magnitude ratio).
- Press **Ch 2**, **Marker→**, **MKR→STOP**, **Cal**, **MORE**, **ELECTRICAL DELAY MENU**, **MKR→DELAY**, **ELECTRICAL DELAY**. Then press **↑** or **↓** and turn the RPG knob to vary the electrical delay until the trace is in the most horizontal position.
- Press **PHASE OFFSET** and enter the trace mean value using numeric keys. The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.
- Press **Search**, **MAX** and **Search**, **MIN** to move the channel 2 marker to the maximum and minimum points on the trace. Compare the absolute values at the maximum and minimum points.
- Record the larger value in the performance test record (“Test Result” column for A/R phase).

## 13. DISPLAYED AVERAGE NOISE LEVEL TEST (SA)

### Description

This test uses the 4395A marker statistics function to measure the displayed average noise level in the 4395A spectrum analyzer mode.

In this test, the noise level (trace mean value) is measured in linear format [Watt]. Then the measured values are converted to log magnitude format [dBm]. This is done to avoid skewing the data with the marker statistics function.

### Specification

#### Displayed average noise level

freq.  $\geq 1$  kHz, ref. level  $\leq -40$  dBm, att.=0 dB .....  $< -120$  dBm/Hz  
freq.  $\geq 100$  kHz, ref. level  $\leq -40$  dBm, att.=0 dB .....  $< -133$  dBm/Hz  
freq.  $\geq 10$  MHz, ref. level  $\leq -40$  dBm, att.=0 dB .....  $< [-145 + f^1/100]$  dBm/Hz

1:  $f$  is measurement frequency (MHz).

### Test Equipment

50 $\Omega$  Termination (three required) ..... 909C Opt. 012 or part of 85032B

### Procedure

1. Connect the test equipment as shown in Figure 2-20.

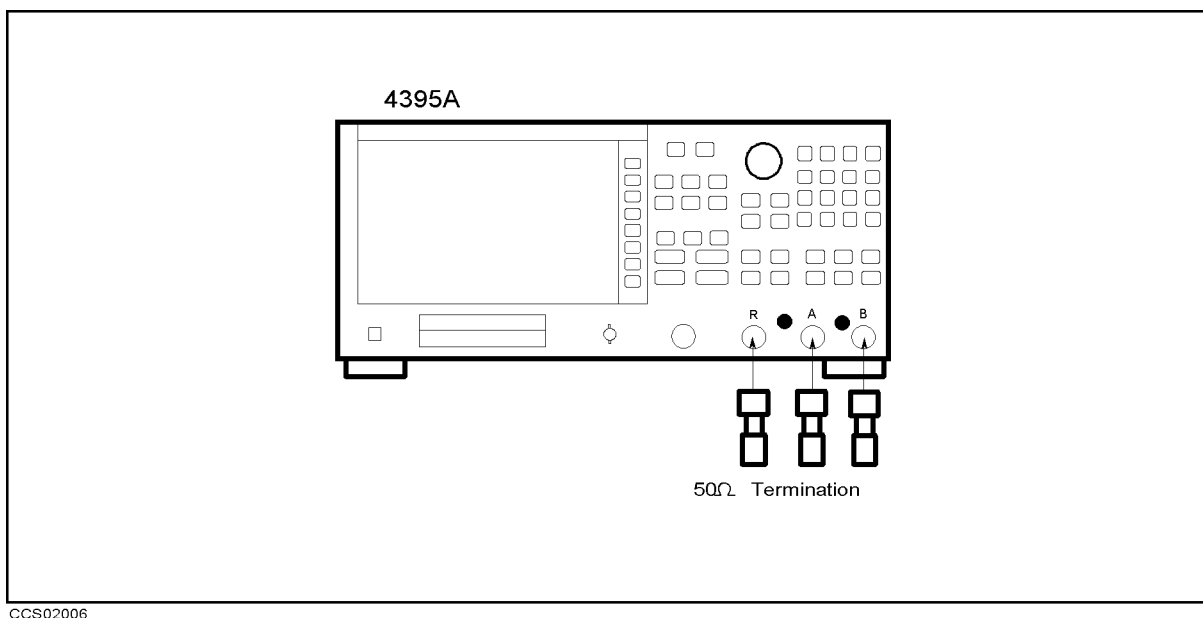


Figure 2-20. Average Noise Level Test Setup



2. Press **[Meas]**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Reference Level: -40 dBm

Input Attenuator R: 0 dB

Input Attenuator A: 0 dB

Input Attenuator B: 0 dB

UNIT: WATT

Statistics: ON

Detection: Sample

**Key Strokes**

**[Scale Ref]**, **REFERENCE VALUE**, **[ ]**, **[4]**, **[0]**, **[x1]**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN R**, **[0]**, **[x1]**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN A**, **[0]**, **[x1]**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN B**, **[0]**, **[x1]**

**[Format]**, **WATT**

**[Utility]**, **STATISTICS on OFF** (Then the softkey label changes to **STATISTICS ON off**.)

**[Meas]**, **DETECTION[xxx]**, **SAMPLE**

3. Press **[Meas]**, **R** to set the 4395A to the R input.
4. Perform the following steps to test the displayed average noise level at the 4395A R input.
  - a. Set the controls as follows. (This sets the center frequency, RBW and frequency span to the first settings listed in Table 2-18).

**Control Settings**

Center Frequency: 1 kHz

RBW: 3 Hz

Frequency Span: 30 Hz

**Key Strokes**

**[Center]**, **[1]**, **[k/m]**

**[Bw/Avg]**, **RES BW**, **[3]**, **[x1]**

**[Span]**, **[3]**, **[0]**, **[x1]**

**Table 2-18. Displayed Average Noise Level Test Settings**

| 4395A            |       |                |
|------------------|-------|----------------|
| Center Frequency | RBW   | Frequency Span |
| 1 kHz            | 3 Hz  | 30 Hz          |
| 10 kHz           | 10 Hz | 100 Hz         |
| 100 kHz          | 10 Hz | 100 Hz         |
| 1 MHz            | 1 kHz | 10 kHz         |
| 11 MHz           | 1 kHz | 10 kHz         |
| 20 MHz           | 1 kHz | 10 kHz         |
| 101 MHz          | 1 kHz | 10 kHz         |
| 201 MHz          | 1 kHz | 10 kHz         |
| 499 MHz          | 1 kHz | 10 kHz         |

- b. Press **[Trigger]**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - c. Record the 4395A trace mean value [Unit] in the calculation sheet ("Trace Mean [Unit]" column). The trace mean value is displayed as a marker statistic (mean) in the upper right-hand corner of the display.
  - d. Change the center frequency, frequency span, and RBW settings in accordance with Table 2-18. Then repeat steps 4-b and 4-c for each setting.
5. Press **[Meas]**, **A** to set the 4395A to the A input.

6. Repeat step 4 to test the displayed average noise level at the 4395A A input.
7. Press **Meas**, **B** to set the 4395A to the B input.
8. Repeat step 4 to test the displayed average noise level at the 4395A B input.
9. Convert the unit of the test results from [Watt] to [dBm] using the equation given in the calculation sheet. Record the test results [dBm] in the performance test record.

---

## 14. AMPLITUDE FIDELITY TEST (SA)

### Description

This test checks the 4395A amplitude fidelity at RBW of 10 kHz. A 50.1 MHz CW signal is applied to the 4395A R input through a step attenuator. The signal amplitude is varied by inserting known attenuation values. Each signal amplitude [dB] is measured to a reference value at the attenuator setting of 10 dB. Then the measured values are compared with to the inserted attenuation's calibrated values.

The amplitude fidelity performance at RBWs  $\leq 3$  kHz are not tested in this test. The error sources at RBW  $\leq 3$  kHz are exactly same as those of the magnitude ratio dynamic accuracy in the 4395A network analyzer mode. Because the dynamic accuracy is tested in the *Magnitude Ratio/Phase Dynamic Accuracy Test*, the fidelity test at the RBW  $\leq 3$  kHz is omitted.

The amplitude fidelity performance at low signal levels are not tested in this test. That is, the fidelity is not checked at signal levels  $\leq -60$  dB (from the reference level) at an RBW of 10 kHz and at signal levels  $\leq -50$  dB (from the reference level) at an RBW of 1 MHz. These tests are not necessary because the fidelity performance at these levels are theoretically determined by the fidelity at higher signal levels and the fidelity at an RBW of  $\leq 3$  kHz.

6 and 10 dB fixed attenuators with a VSWR of  $\leq 1.015$  are connected to the signal generator output connector and the 4395A S input, respectively. These fixed attenuators are used to reduce the measurement uncertainties caused by mismatch error. When they are used, the measurement uncertainties listed in the performance test record are valid.

### Specification

#### Amplitude fidelity

##### Log scale

| Range<br>(relative to full scale input level) | Amplitude Fidelity <sup>1</sup> |
|-----------------------------------------------|---------------------------------|
| 0 dB $\geq$ range $> -30$ dB                  | $\pm 0.05$ dB                   |
| $-30$ dB $>$ range $\geq -40$ dB              | $\pm 0.07$ dB                   |
| $-40$ dB $>$ range $\geq -50$ dB              | $\pm 0.15$ dB                   |
| $-50$ dB $>$ range $\geq -60$ dB              | $\pm 0.35$ dB                   |
| $-60$ dB $>$ range $\geq -70$ dB              | $\pm 0.8$ dB                    |
| $-70$ dB $>$ range $\geq -80$ dB              | $\pm 1.8$ dB                    |

1 @23 $\pm$ 5°C, RBW = 10 Hz,  $-20$  dBm  $\geq$  *ref. value*  $\geq$   $+30$  dBm, *ref. input level* = *full scale input level*  $-10$  dB

### Test Equipment

|                                                                   |                           |
|-------------------------------------------------------------------|---------------------------|
| Signal Generator .....                                            | 8663A                     |
| Step Attenuator <sup>1</sup> , 10 dB step, VSWR $\leq 1.02$ ..... | 8496G Opt. 001 and H60    |
| Attenuator Driver .....                                           | 11713A                    |
| Type-N Cable, 61 cm (two required) .....                          | 11500B or part of 11851B  |
| BNC cable, 122 cm .....                                           | PN 8120-1840              |
| 6 dB Fixed Attenuation, VSWR $\leq 1.015$ .....                   | 8491A Opt. 006 & Opt. H60 |
| 10 dB Fixed Attenuation, VSWR $\leq 1.015$ .....                  | 8491A Opt. 010 & Opt. H60 |

- 1: Calibration values for attenuation settings of 10 dB to 60 dB at 50 MHz are required.

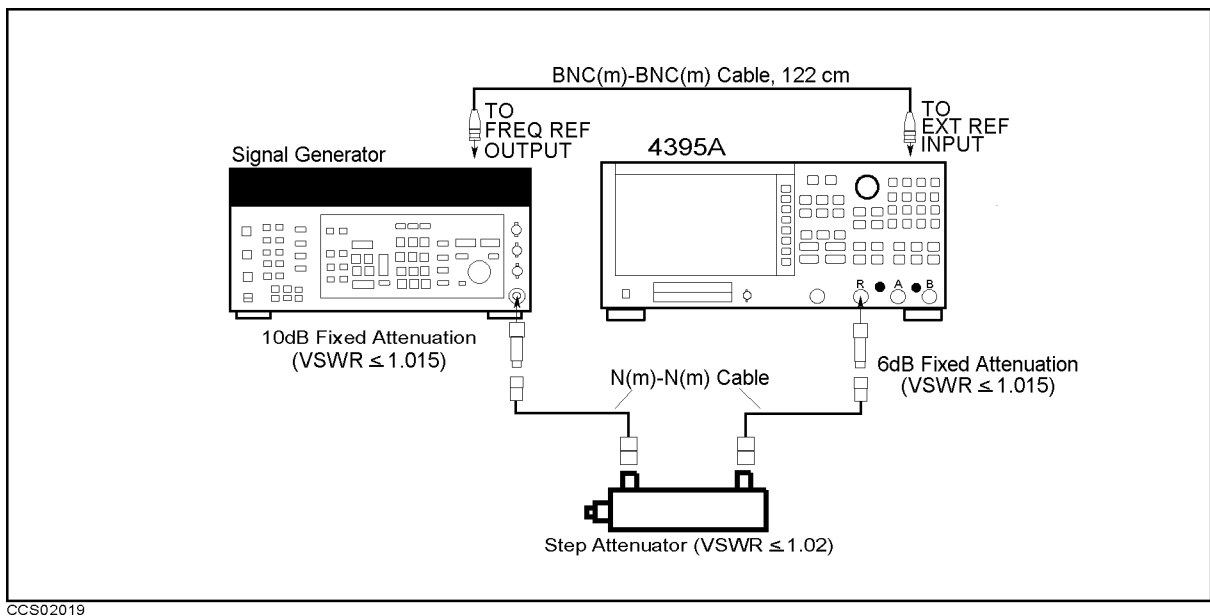
## Procedure

1. Record the step attenuator 50 MHz calibration values in the calculation sheet (“Calibration Value” column).
2. Connect the test equipment as shown in Figure 2-21.

## Note



Connect the signal generator’s 10 MHz frequency reference output to the 4395A EXT REF Input on the rear panel as shown in Figure 2-21. With this configuration, both the signal generator and the 4395A are phase locked to the same reference frequency to obtain a stable measurement.



**Figure 2-21. Amplitude Fidelity Test Setup 1**

3. Initialize the signal generator. Then set the controls as follows:

| Controls  | Settings |
|-----------|----------|
| Frequency | 50.1 MHz |
| Amplitude | 6 dBm    |

4. Press **[Meas]**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows

| Control Settings           | Key Strokes                                                                        |
|----------------------------|------------------------------------------------------------------------------------|
| Center Frequency: 50.1 MHz | <b>[Center]</b> , <b>[5]</b> , <b>[0]</b> , <b>[.]</b> , <b>[1]</b> , <b>[M/μ]</b> |
| Frequency Span: 120 Hz     | <b>[Span]</b> , <b>[1]</b> , <b>[2]</b> , <b>[0]</b> , <b>[x1]</b>                 |
| RBW: 10 Hz                 | <b>[Bw/Avg]</b> , <b>RES BW</b> , <b>[1]</b> , <b>[0]</b> , <b>[x1]</b>            |
| Video BW: 10 Hz            | <b>[Bw/Avg]</b> , <b>VIDEO BW</b> , <b>[1]</b> , <b>[0]</b> , <b>[x1]</b>          |

5. Press **[Meas]**, **R** to set the 4395A to the R input.

6. Press **Scale Ref**, **REFERENCE VALUE**, **[ ]**, **[1]**, **[0]**, **[x1]**, **Scale Ref**, **ATTENUATOR MENU**, **ATTEN R**, **[1]**, **[0]**, **[x1]**, to set the 4395A controls to the reference setting for the test.
7. Set the step attenuator to 10 dB.
8. Perform the following steps to measure the amplitude fidelity.
  - a. On the 4395A, press **Search**, **MAX** to move the marker to the peak of the carrier.
  - b. On the signal generator, adjust the amplitude until the 4395A marker reads  $-20\text{ dB} \pm 0.1\text{ dB}$ .
  - c. On the 4395A, press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - d. Press **Search**, **MAX**, **Marker**, **ΔMODE MENU**, **FIXED ΔMKR** to place the delta reference marker on the peak of the carrier (reference level of the amplitude fidelity).
  - e. Set the step attenuator to the first setting 20 dB in the second column of Table 2-19.

**Table 2-19. Amplitude Fidelity Test Settings**

| dB from<br>Reference Input Level | Step Attenuator |
|----------------------------------|-----------------|
| -10 dB                           | 20 dB           |
| -20 dB                           | 30 dB           |
| -30 dB                           | 40 dB           |
| -40 dB                           | 50 dB           |
| -50 dB                           | 60 dB           |
| -60 dB                           | 70 dB           |
| -70 dB                           | 80 dB           |

- f. Perform the following steps to measure the amplitude fidelity.
  - i. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - ii. Press **Search**, **MAX**.
  - iii. Record the delta marker reading in the calculation sheet for the amplitude fidelity. Use the “4395A Reading” column corresponding to the dB from the reference level in the first column of Table 2-19.
- g. Change the step attenuator setting in accordance with the second column of Table 2-19. Then perform step 8-f for each setting.
9. Remove the fixed attenuation from the R input, and connect it to the A input.
10. Press **Meas**, **A** to set the 4395A to the A input.
11. Press **Scale Ref**, **REFERENCE VALUE**, **[ ]**, **[1]**, **[0]**, **[x1]**, **Scale Ref**, **ATTENUATOR MENU**, **ATTEN A**, **[1]**, **[0]**, **[x1]**, to set the 4395A controls to the reference setting for the test.
12. Set the step attenuator to 10 dB.
13. Repeat step 8 to measure the amplitude fidelity at the 4395A A input.
14. Remove the fixed attenuation from the A input, and connect it to the B input.
15. Press **Meas**, **B** to set the 4395A to the B input.

16. Press **Scale Ref**, **REFERENCE VALUE**, **[-]**, **[1]**, **[0]**, **[x1]**, **Scale Ref**, **ATTENUATOR MENU**, **ATTEN B**, **[1]**, **[0]**, **[x1]**, to set the 4395A controls to the reference setting for the test.
17. Set the step attenuator to 10 dB.
18. Repeat step 8 to measure the amplitude fidelity at the 4395A B input.
19. Calculate the test results using the equations given in the calculation sheet. Record the test results in the performance test record.
20. Initialize the signal generator. Then set the controls as follows:

| Controls  | Settings |
|-----------|----------|
| Frequency | 50.1 MHz |
| Amplitude | 6 dBm    |

21. Press **Meas**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **Preset** to initialize the 4395A. Then set the controls as follows

| Control Settings           | Key Strokes                                                                    |
|----------------------------|--------------------------------------------------------------------------------|
| Center Frequency: 50.1 MHz | <b>Center</b> , <b>[5]</b> , <b>[0]</b> , <b>[.]</b> , <b>[1]</b> , <b>M/μ</b> |
| Frequency Span: 120 Hz     | <b>Span</b> , <b>[1]</b> , <b>[2]</b> , <b>[0]</b> , <b>[x1]</b>               |
| RBW: 10 Hz                 | <b>Bw/Avg</b> , <b>RES BW</b> , <b>[1]</b> , <b>[0]</b> , <b>[x1]</b>          |
| Video BW: 10 Hz            | <b>Bw/Avg</b> , <b>VIDEO BW</b> , <b>[1]</b> , <b>[0]</b> , <b>[x1]</b>        |

22. Press **Meas**, **R** to set the 4395A to the R input.
23. Press **Scale Ref**, **REFERENCE VALUE**, **[-]**, **[1]**, **[0]**, **[x1]**, **Scale Ref**, **ATTENUATOR MENU**, **ATT R**, **[0]**, **[x1]**, to set the 4395A controls to the reference setting for the test.
24. Set the step attenuator to 20 dB.
25. Perform the following steps to measure the amplitude fidelity.
  - a. On the 4395A, press **Search**, **MAX** to move the marker to the peak of the carrier.
  - b. On the signal generator, adjust the amplitude until the 4395A marker reads  $-30 \text{ dB} \pm 0.1 \text{ dB}$ .
  - c. On the 4395A, press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - d. Press **Search**, **MAX**, **Marker**, **ΔMODE MENU**, **FIXED ΔMKR** to place the delta reference marker on the peak of the carrier (reference level of the amplitude fidelity).
  - e. Set the step attenuator to 10 dB.
  - f. Perform the following steps to measure the amplitude fidelity.
    - i. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
    - ii. Press **Search**, **MAX**.
    - iii. Record the delta marker reading in the calculation sheet for the amplitude fidelity.
26. Remove the fixed attenuation from the R input, and connect it to the A input.
27. Press **Meas**, **A** to set the 4395A to the A input.
28. Press **Scale Ref**, **REFERENCE VALUE**, **[-]**, **[1]**, **[0]**, **[x1]**, **Scale Ref**, **ATTENUATOR MENU**, **ATT A**, **[0]**, **[x1]**, to set the 4395A controls to the reference setting for the test.
29. Set the step attenuator to 20 dB.

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30. Repeat step 25 to measure the amplitude fidelity at the 4395A A input.
31. Remove the fixed attenuation from the A input, and connect it to the B input.
32. Press **Meas**, **B** to set the 4395A to the B input.
33. Press **Scale Ref**, **REFERENCE VALUE**, **-**, **1**, **0**, **x1**, **Scale Ref**, **ATTENUATOR MENU**, **ATT B**, **0**, **x1**, to set the 4395A controls to the reference setting for the test.
34. Set the step attenuator to 20 dB.
35. Repeat step 25 to measure the amplitude fidelity at the 4395A B input.

---

## 15. INPUT ATTENUATOR SWITCHING UNCERTAINTY TEST (SA)

### Description

This test measures the 4395A input attenuator switching uncertainty over the entire range from 0 dB to 50 dB. The switching uncertainty is referenced to the 10 dB attenuator setting.

In this test, a 50.1 MHz CW signal is applied to the 4395A input through a step attenuator. The signal amplitude is measured at each 4395A input attenuator setting. At each measurement, the other measurement conditions are kept constant to measure the switching uncertainty exclusively. The applied signal level is controlled using the step attenuator so as to keep the signal level input to the first mixer (the internal circuit stage following the input attenuator) constant. For example, the step attenuator is decreased by 10 dB, when the 4395A input attenuator is increased by 10 dB. The 4395A reference level is set to the value of the input attenuator setting – 40 dB. This keeps the 4395A internal IF gain constant.

### Specification

#### A input attenuator switching uncertainty

|                                            |          |
|--------------------------------------------|----------|
| @0 dB to 30 dB, referenced to 10 dB .....  | <±1.0 dB |
| @40 dB to 50 dB, referenced to 10 dB ..... | <±1.5 dB |

### Test Equipment

|                                                              |                           |
|--------------------------------------------------------------|---------------------------|
| Signal Generator .....                                       | 8663A                     |
| Step Attenuator <sup>1</sup> , 10 dB step, VSWR ≤ 1.02 ..... | 8496G Opt. 001 and H60    |
| Attenuator driver <sup>2</sup> .....                         | 11713A                    |
| Type-N Cable, 61 cm (two required) .....                     | 11500B or part of 11851B  |
| BNC cable, 122 cm .....                                      | PN 8120-1840              |
| 6 dB Fixed Attenuation, VSWR ≤ 1.015 (two required) .....    | 8491A Opt. 006 & Opt. H60 |

1: Calibration values for attenuation settings of 10 dB to 50 dB at 50 MHz are required.

### Procedure

1. Record the step attenuator 50 MHz calibration values in the calculation sheet (“Calibration Value” column).
2. Set the step attenuator to 40 dB.
3. On the signal generator, initialize the signal generator. Then set the controls as follows:

| Controls  | Settings |
|-----------|----------|
| Frequency | 50.1 MHz |
| Amplitude | +12 dBm  |

4. Connect the test equipment as shown in Figure 2-22.

---

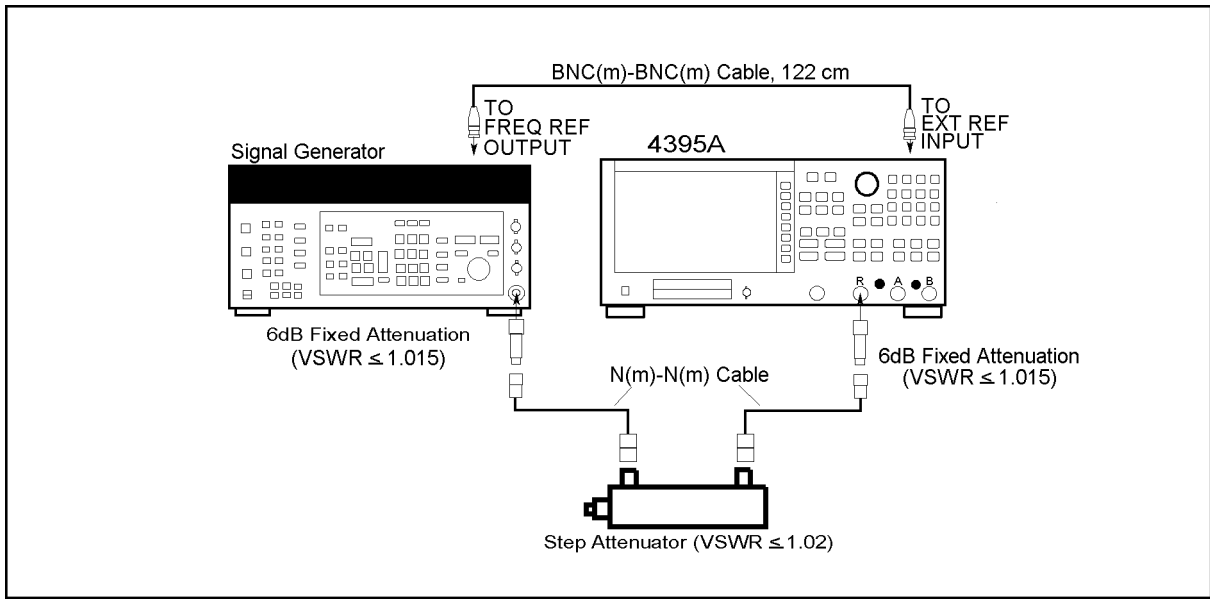
### Note



Connect the signal generator's 10 MHz frequency reference output to the 4395A EXT REF Input on the rear panel as shown in Figure 2-22. With this configuration, both the signal generator and the 4395A are phase locked to the same reference frequency to obtain a stable measurement.

---





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**Figure 2-22. Input Attenuator Accuracy Test Setup**

5. Press **[Meas]**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Center Frequency: 50.1 MHz

Frequency Span: 120 Hz

RBW: 10 Hz

Scale/Division: 5 dB/Div

**Key Strokes**

**[Center]**, **[5]**, **[0]**, **[.]**, **[1]**, **[M/μ]**

**[Span]**, **[1]**, **[2]**, **[0]**, **[x1]**

**[Bw/Avg]**, **RES BW**, **[1]**, **[0]**, **[x1]**

**[Scale Ref]**, **SCALE/DIV**, **[5]**, **[x1]**

6. Press **[Meas]**, **R** to set the 4395A to the R input.
7. Press **[Scale Ref]**, **REFERENCE VALUE**, **[.]**, **[3]**, **[0]**, **[x1]**, **[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN R**, **[1]**, **[0]**, **[x1]**, to set the 4395A controls to the reference setting for the test.
8. Perform the following steps to measure the input attenuator switching uncertainty.
  - a. Press **[Trigger]**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - b. Press **[Search]**, **MAX**, **[Marker]**, **ΔMODE MENU**, **FIXED ΔMKR** to place the delta reference marker on the peak of the carrier.
  - c. Set the 4395A controls as follows. This sets the input attenuator and reference level to the first settings listed in Table 2-20.

**Control Settings**

Input Attenuator R: 0 dB

Reference Level: -40 dBm

**Key Strokes**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN R**, **[0]**, **[x1]**

**[Scale Ref]**, **REFERENCE VALUE**, **[.]**, **[4]**, **[0]**, **[x1]**

**Table 2-20. Input Attenuator Switching Uncertainty Test Settings**

| 4395A            |                 | Step Attenuator |
|------------------|-----------------|-----------------|
| Input Attenuator | Reference Level |                 |
| 0 dB             | −40 dBm         | 50 dB           |
| 20 dB            | −20 dBm         | 30 dB           |
| 30 dB            | −10 dBm         | 20 dB           |
| 40 dB            | 0 dBm           | 10 dB           |
| 50 dB            | 10 dBm          | 0 dB            |

- d. Set the step attenuator to the first setting 50 dB listed in the third column of Table 2-20.
  - e. Perform the following steps.
    - i. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
    - ii. Press **Search**, **MAX**.
    - iii. Record the delta marker reading in the calculation sheet (“4395A Reading” column).
  - f. Change the 4395A input attenuator setting, the reference level setting, and the step attenuator setting in accordance with Table 2-20. Repeat step 8-e for each setting.
9. Remove the fixed attenuation from the R input, and connect it to the A input.
  10. Press **Meas**, **A** to set the 4395A to the A input.
  11. Press **Scale Ref**, **REFERENCE VALUE**, **-**, **3**, **0**, **x1**, **Scale Ref**, **ATTENUATOR MENU**, **ATTEN A**, **1**, **0**, **x1**, to set the 4395A controls to the reference setting for the test.
  12. Repeat step 8 to measure the input attenuator switching uncertainty at the 4395A A input.
  13. Remove the fixed attenuation from the A input, and connect it to the B input.
  14. Press **Meas**, **B** to set the 4395A to the B input.
  15. Press **Scale Ref**, **REFERENCE VALUE**, **-**, **3**, **0**, **x1**, **Scale Ref**, **ATTENUATOR MENU**, **ATTEN B**, **1**, **0**, **x1**, to set the 4395A controls to the reference setting for the test.
  16. Repeat step 8 to measure the input attenuator switching uncertainty at the 4395A A input.
  17. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.

---

# 16. NOISE SIDEBANDS TEST (SA)

## Description

This test applies 10 MHz, 100 MHz, and 500 MHz CW frequency signals to the 4395A R input. Then this measures noise sidebands at offsets 1 kHz, 10 kHz, 100 kHz and 1 MHz from each carrier using a 4395A NOISE FORM function. Using the noise form function and the delta marker mode, the noise sidebands level is displayed directly in [dBc/Hz].

## Specification

### Noise sidebands

| Offset from Carrier   | Noise Sidebands        |
|-----------------------|------------------------|
| $\geq 1\text{ kHz}$   | $< -97\text{ dBc/Hz}$  |
| $\geq 100\text{ kHz}$ | $< -110\text{ dBc/Hz}$ |

## Test Equipment

|                           |                          |
|---------------------------|--------------------------|
| Signal Generator .....    | 8663A                    |
| Type-N Cable, 61 cm ..... | 11500B or part of 11851B |
| BNC cable, 122 cm .....   | PN 8120-1840             |

## Procedure

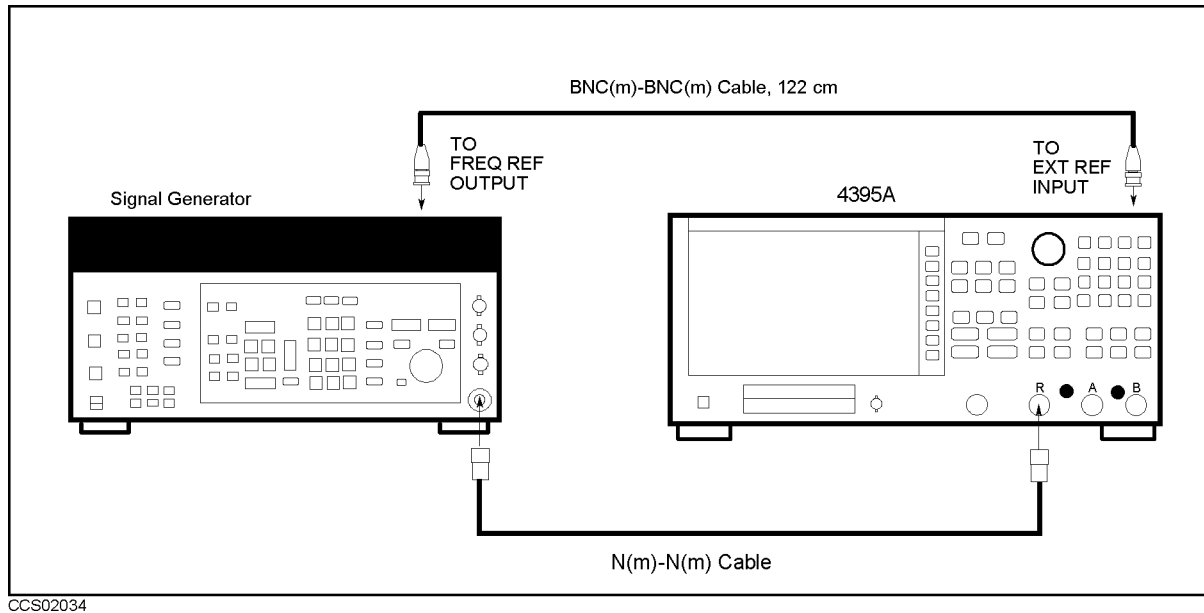
1. Initialize the signal generator. Then set the amplitude to 0 dBm.
2. Connect the test equipment as shown in Figure 2-23.

### Note



Connect the signal generator's 10 MHz frequency reference output to the 4395A EXT REF Input on the rear panel as shown in Figure 2-23. With this configuration, both the signal generator and the 4395A are phase locked to the same reference frequency to obtain a stable measurement.

---



**Figure 2-23. Noise Sidebands Test Setup**

- Press **[Meas]**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Input Port: R

Reference Level: 0 dBm

Noise Form: ON

Input Attenuator: Auto

**Key Strokes**

**[Meas]** **R**

**[Scale Ref]**, **REFERENCE VALUE**, **[0]**, **[x1]**

**[Utility]**, **NOISE FORM on OFF** (Then the softkey label changes to **NOISE FORM ON off**.)

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN auto MAN**  
(Then the softkey label changes to **ATTEN AUTO man**).

- On the signal generator, set the frequency to the first carrier frequency 10 MHz in Table 2-21.

**Table 2-21. Noise Sideband Test Settings**

| Signal Generator<br>Carrier Frequency | 4395A               |        |        |                | Offset<br>from Carrier |
|---------------------------------------|---------------------|--------|--------|----------------|------------------------|
|                                       | Center<br>Frequency | RBW    | VBW    | Frequency Span |                        |
| 10 MHz                                | 10 MHz              | 100 Hz | 1 Hz   | 2.5 kHz        | ±1 kHz                 |
|                                       |                     | 1 kHz  | 3 Hz   | 25 kHz         | ±10 kHz                |
|                                       |                     | 1 kHz  | 10 Hz  | 250 kHz        | ±100 kHz               |
|                                       |                     | 10 kHz | 100 Hz | 2.5 MHz        | ±1 MHz                 |
| 100 MHz                               | 100 MHz             | 100 Hz | 1 Hz   | 2.5 kHz        | ±1 kHz                 |
|                                       |                     | 1 kHz  | 3 Hz   | 25 kHz         | ±10 kHz                |
|                                       |                     | 1 kHz  | 10 Hz  | 250 kHz        | ±100 kHz               |
|                                       |                     | 10 kHz | 100 Hz | 2.5 MHz        | ±1 MHz                 |
| 500 MHz                               | 500 MHz             | 100 Hz | 1 Hz   | 2.5 kHz        | ±1 kHz                 |
|                                       |                     | 1 kHz  | 3 Hz   | 25 kHz         | ±10 kHz                |
|                                       |                     | 1 kHz  | 10 Hz  | 250 kHz        | ±100 kHz               |
|                                       |                     | 10 kHz | 100 Hz | 2.5 MHz        | ±1 MHz                 |

5. On the 4395A, press **Center**, **(1)**, **(0)**, **(M/μ)** to set the center frequency to 10 MHz.
6. Perform the following steps to measure the noise sideband level at each offset value.
  - a. On the 4395A, set the controls as follows:
 

|                         |                                                                                    |
|-------------------------|------------------------------------------------------------------------------------|
| <b>Control Settings</b> | <b>Key Strokes</b>                                                                 |
| RBW: 100 Hz             | <b>Bw/Avg</b> , <b>RES BW</b> , <b>(1)</b> , <b>(0)</b> , <b>(0)</b> , <b>(x1)</b> |
| Video BW: 1 Hz          | <b>Bw/Avg</b> , <b>VIDEO BW</b> , <b>(1)</b> , <b>(x1)</b>                         |
| Frequency Span: 2.5 kHz | <b>Span</b> , <b>(2)</b> , <b>(.)</b> , <b>(5)</b> , <b>(k/m)</b>                  |
  - b. Perform the following steps to measure the noise sideband level at ±1 kHz offset from the carrier.
    - i. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
    - ii. Press **Search**, **MAX**, **Marker**, **ΔMODE MENU**, **ΔMKR** to place the delta marker reference at the peak of the carrier.
    - iii. Press **(-)**, **(1)**, **(k/m)** to move the delta marker to an offset of -1 kHz from the carrier.
    - iv. Record the delta marker reading in the performance test record.
    - v. Press **(1)**, **(k/m)** to move the delta marker to an offset of +1 kHz from the carrier.
    - vi. Record the delta marker reading in the performance test record.
  - c. On the 4395A, set the controls as follows:
 

|                         |                                                            |
|-------------------------|------------------------------------------------------------|
| <b>Control Settings</b> | <b>Key Strokes</b>                                         |
| RBW: 1 kHz              | <b>Bw/Avg</b> , <b>RES BW</b> , <b>(1)</b> , <b>(k/m)</b>  |
| Video BW: 3 Hz          | <b>Bw/Avg</b> , <b>VIDEO BW</b> , <b>(3)</b> , <b>(x1)</b> |
| Frequency Span: 25 kHz  | <b>Span</b> , <b>(2)</b> , <b>(5)</b> , <b>(k/m)</b>       |
  - d. Perform the following steps to measure the noise sideband level at ±10 kHz offset from the carrier.
    - i. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
    - ii. Press **Search**, **MAX**, **Marker**, **ΔMODE MENU**, **ΔMKR** to place the delta marker reference at the peak of the carrier.

- iii. Press **[−]**, **[1]**, **[0]**, **[k/m]** to move the delta marker to an offset of −10 kHz from the carrier.
- iv. Record the delta marker reading in the performance test record.
- v. Press **[1]**, **[0]**, **[k/m]** to move the delta marker to an offset of +10 kHz from the carrier.
- vi. Record the delta marker reading in the performance test record.
- e. On the 4395A, set the controls as follows:
 

| <b>Control Settings</b> | <b>Key Strokes</b>                                                        |
|-------------------------|---------------------------------------------------------------------------|
| Video BW: 10 Hz         | <b>[Bw/Avg]</b> , <b>VIDEO BW</b> , <b>[1]</b> , <b>[0]</b> , <b>[x1]</b> |
| Frequency Span: 250 kHz | <b>[Span]</b> , <b>[2]</b> , <b>[5]</b> , <b>[0]</b> , <b>[k/m]</b>       |
- f. Perform the following steps to measure the noise sideband level at +100 kHz offset from the carrier.
  - i. Press **[Trigger]**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - ii. Press **[Search]**, **MAX**, **[Marker]**, **ΔMODE MENU**, **ΔMKR** to place the delta marker reference at the peak of the carrier.
  - iii. Press **[−]**, **[1]**, **[0]**, **[0]**, **[k/m]** to move the delta marker to an offset of −100 kHz from the carrier.
  - iv. Record the delta marker reading in the performance test record.
  - v. Press **[1]**, **[0]**, **[0]**, **[k/m]** to move the delta marker to an offset of +100 kHz from the carrier.
  - vi. Record the delta marker reading in the performance test record.
- g. On the 4395A, set the controls as follows:
 

| <b>Control Settings</b> | <b>Key Strokes</b>                                                                     |
|-------------------------|----------------------------------------------------------------------------------------|
| RBW: 10 kHz             | <b>[Bw/Avg]</b> , <b>RES BW</b> , <b>[1]</b> , <b>[0]</b> , <b>[k/m]</b>               |
| Video BW: 100 Hz        | <b>[Bw/Avg]</b> , <b>VIDEO BW</b> , <b>[1]</b> , <b>[0]</b> , <b>[0]</b> , <b>[x1]</b> |
| Frequency Span: 2.5 MHz | <b>[Span]</b> , <b>[2]</b> , <b>[ ]</b> , <b>[5]</b> , <b>[M/μ]</b>                    |
- h. Perform the following steps to measure the noise sideband level at +1 MHz offset from the carrier. `uutmkrmaxkey`
  - i. Press **[Trigger]**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - ii. Press **[Search]**, **MAX**, **[Marker]**, **ΔMODE MENU**, **ΔMKR** to place the delta marker reference at the peak of the carrier.
  - iii. Press **[−]**, **[1]**, **[M/μ]** to move the delta marker to an offset of −1 MHz from the carrier.
  - iv. Record the delta marker reading in the performance test record.
  - v. Press **[1]**, **[M/μ]** to move the delta marker to an offset of +1 MHz from the carrier.
  - vi. Record the delta marker reading in the performance test record.
7. On the signal generator, set the frequency to the next center frequency 100 MHz in Table 2-21.
8. On the 4395A, press **[Center]**, **[1]**, **[0]**, **[0]**, **[M/μ]** to set the center frequency to 100 MHz.
9. Repeat step 6 to measure the noise sideband level from the carrier of 100 MHz.
10. On the signal generator, set the frequency to the next center frequency 500 MHz in Table 2-21.
11. On the 4395A, press **[Center]**, **[5]**, **[0]**, **[0]**, **[M/μ]** to set the center frequency to 500 MHz.
12. Repeat step 6 to measure the noise sideband level from the carrier of 500 MHz.

---

## 17. AMPLITUDE ACCURACY/FREQUENCY RESPONSE TEST (SA)

### Description

This test measures the amplitude measurement accuracy of the 4395A spectrum measurement over the entire frequency range. The frequency response is calculated as the accuracy deviation from the absolute amplitude accuracy at a frequency of 50 MHz.

At frequency ranges  $\geq 1$  MHz, this test applies a CW signal to the 4395A input and power meter through a power splitter. The signal level is measured by doing a 4395A spectrum measurement using a power meter and a power sensor. Then the 4395A reading is compared with the reading of the power meter to obtain the absolute amplitude accuracy. These tests are performed twice while reversing connections of the power splitter's two output ports. This is done to remove the frequency tracking between two output ports of the power splitter.

At low frequencies ( $< 1$  MHz), this test measures the CW signal level of the function generator using the 4395A spectrum measurement. The function generator's output level is used as the measurement standard.

### Specification

#### Amplitude accuracy

@-20 dBm input, 50 MHz, input att.= 10 dB,  $23\pm5^{\circ}\text{C}$  .....  $<\pm 0.8$  dB

#### Frequency response

@-20 dBm input, input att.= 10dB, referenced to level at 50 MHz,  $23\pm5^{\circ}\text{C}$

frequency  $\geq 100$  Hz .....  $<\pm 1.3$  dB

frequency  $< 100$  Hz .....  $<\pm 3.0$  dB

### Test Equipment

|                              |                              |
|------------------------------|------------------------------|
| Power Meter .....            | 436A Opt. 022, 437B, or 438A |
| Power Sensor .....           | 8482A                        |
| Signal Generator .....       | 8663A                        |
| Function Genarator .....     | 3325A                        |
| Two-Way Power Splitter ..... | 11667A                       |
| Type-N Cable, 61 cm .....    | 11500B or part of 11851B     |
| BNC cable, 61 cm .....       | PN 8120-1839                 |
| BNC cable, 122 cm .....      | PN 8120-1840                 |
| N(m)-N(m) adapter .....      | PN 1250-1475                 |
| N(m)-BNC(f) adapter .....    | PN 1250-0780                 |

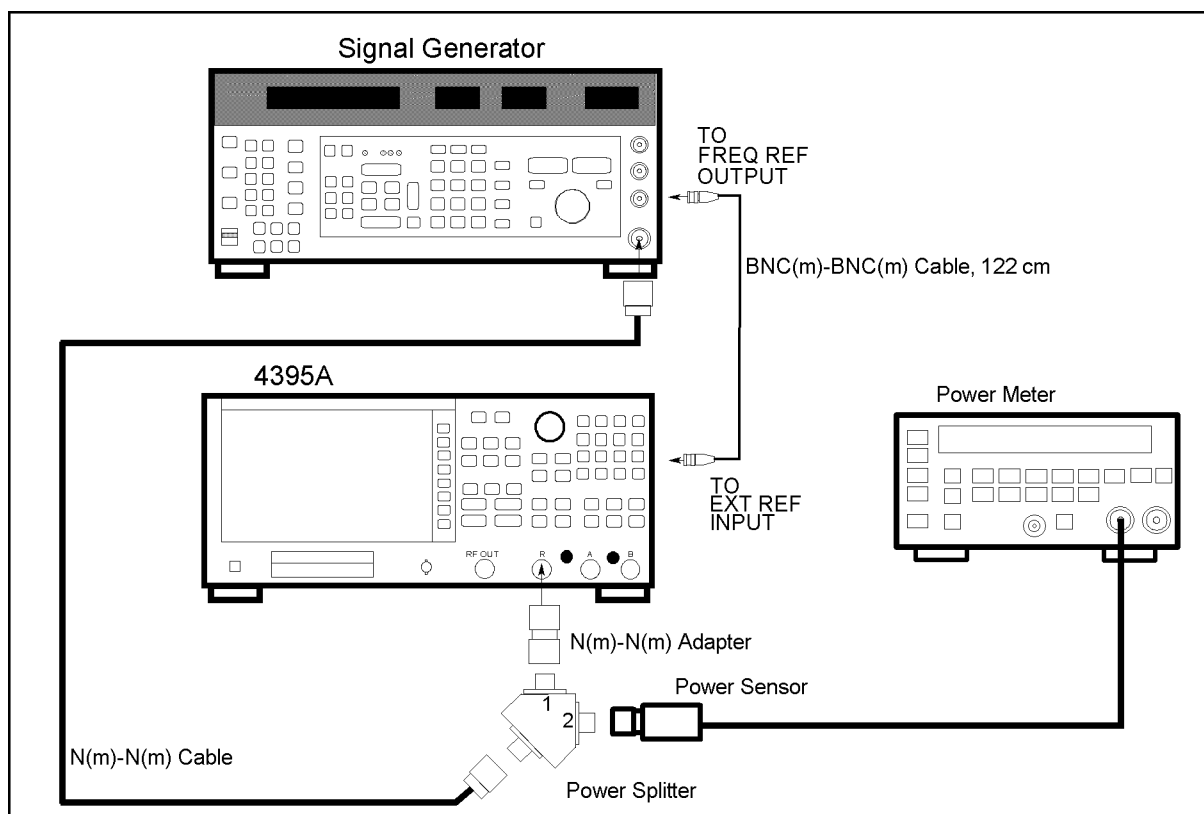
### Procedure

#### 1. For testing high frequencies

- a. Connect the power sensor to the power meter. Calibrate the power meter for the power sensor.
- b. Connect the test equipment as shown in Figure 2-24.

**Note**

Connect the signal generator's 10 MHz frequency reference output to the 4395A EXT REF Input on the rear panel as shown in Figure 2-24. With this configuration, both the signal generator and the 4395A are phase locked to the same reference frequency to obtain a stable measurement.



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**Figure 2-24. Frequency Response Test Setup 1**

- c. Initialize the signal generator. Then set the amplitude to  $-14$  dBm.
- d. Press **[Meas]**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Frequency Span: 1 kHz  
 Reference Level:  $-10$  dBm  
 Scale/Division: 1 dB/Div

**Key Strokes**

**[Span]**, **[1]**, **[k/m]**  
**[Scale Ref]**, **REFERENCE VALUE**, **[−]**, **[1]**, **[0]**, **[x1]**  
**[Scale Ref]**, **SCALE/DIV**, **[1]**, **[x1]**

- e. Press **[Meas]**, **R** to set the 4395A to the R input.
- f. Press **[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN R**, **[1]**, **[0]**, **[x1]** to set the input attenuator to 10 dB.
- g. Press **[Bw/Avg]**, **RES BW**, **[3]**, **[0]**, **[0]**, **[k/m]** in the first column of Table 2-22. Table 2-22 lists the test settings at frequencies  $\geq 1$  MHz.

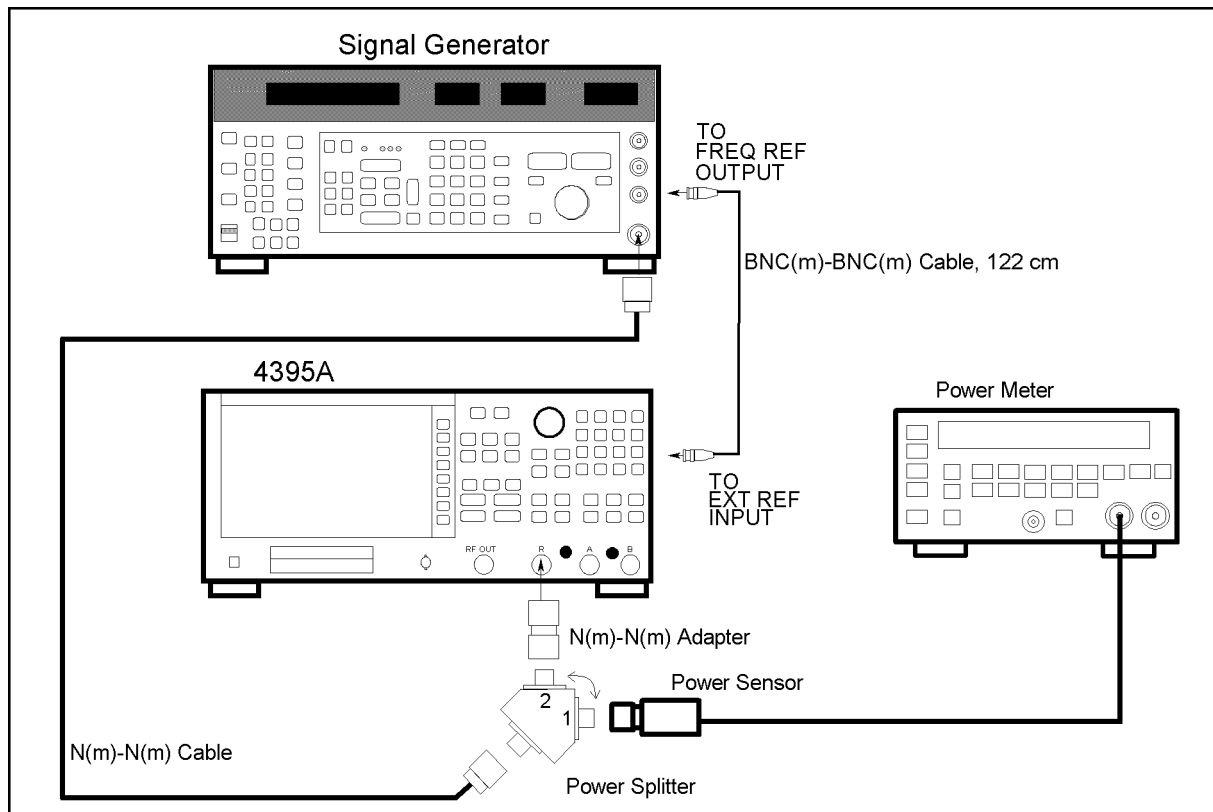


- h. On the signal generator, set the frequency to the first frequency 50 MHz in the first column of Table 2-22.

**Table 2-22. Frequency Response Test Settings 1**

| Signal Generator<br>Frequency | 4395A            |         |
|-------------------------------|------------------|---------|
|                               | Center Frequency | RBW     |
| 50 MHz                        | 50 MHz           | 300 kHz |
| 1 MHz                         | 1 MHz            | 100 Hz  |
| 2 MHz                         | 2 MHz            | 100 Hz  |
| 5 MHz                         | 5 MHz            | 100 Hz  |
| 8 MHz                         | 8 MHz            | 100 Hz  |
| 10 MHz                        | 10 MHz           | 100 Hz  |
| 20 MHz                        | 20 MHz           | 100 Hz  |
| 100 MHz                       | 100 MHz          | 100 Hz  |
| 125 MHz                       | 125 MHz          | 100 Hz  |
| 150 MHz                       | 150 MHz          | 100 Hz  |
| 175 MHz                       | 175 MHz          | 100 Hz  |
| 200 MHz                       | 200 MHz          | 100 Hz  |
| 225 MHz                       | 225 MHz          | 100 Hz  |
| 250 MHz                       | 250 MHz          | 100 Hz  |
| 275 MHz                       | 275 MHz          | 100 Hz  |
| 300 MHz                       | 300 MHz          | 100 Hz  |
| 325 MHz                       | 325 MHz          | 100 Hz  |
| 375 MHz                       | 375 MHz          | 100 Hz  |
| 400 MHz                       | 400 MHz          | 100 Hz  |
| 425 MHz                       | 425 MHz          | 100 Hz  |
| 450 MHz                       | 450 MHz          | 100 Hz  |
| 475 MHz                       | 475 MHz          | 100 Hz  |
| 500 MHz                       | 500 MHz          | 100 Hz  |

- i. On the 4395A, press **Center**, **5**, **0**, **M/μ** to set the center frequency to the first setting 50 MHz in Table 2-22.
- j. Perform the following steps to measure the frequency response.
- Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - Press **Search**, **SEARCH: PEAK** to place the marker at the peak of the carrier.
  - Record the 4395A marker reading and power meter reading in the “4395A Reading 1” and “Power Meter Reading 1” columns of the calculation sheet for the 50 MHz reference.
- k. Change the signal generator frequency, the 4395A center frequency and RBW in accordance with Table 2-22. Then repeat step 1-j for each setting. Record the 4395A marker reading and power meter reading in the “4395A Reading 1” and “Power Meter Reading 1” columns of the calculation sheet for frequencies  $\geq 1$  MHz.
- l. Reverse the power splitter output connections as shown in Figure 2-25.

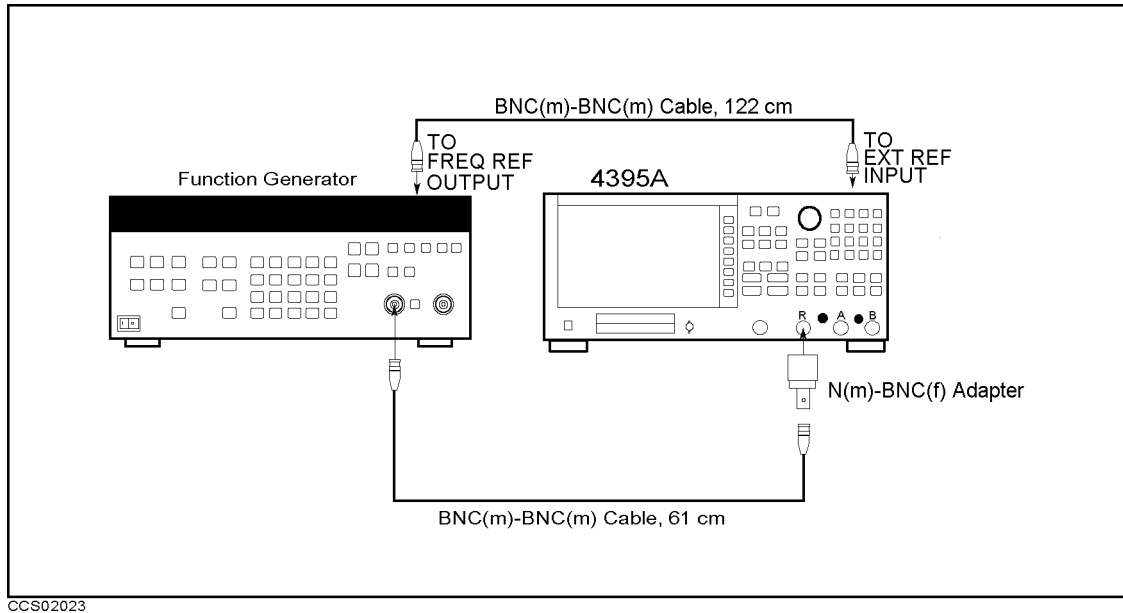


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**Figure 2-25. Frequency Response Test Setup 2**

- m. Repeat steps 1-g through 1-k to remove the power splitter tracking characteristic. Record the 4395A marker reading and power meter reading in the “4395A Reading 2” and “Power Meter Reading 2” columns of the calculation sheet.
- n. Remove the power splitter from the R input, and connect it directly to the A input.
- o. Press **[Meas]**, **A** to set the 4395A to the A input.
- p. Press **[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN A**, **[1]**, **[0]**, **[x1]** to set the input attenuator to 10 dB.
- q. Press **[Bw/Avg]**, **RES BW**, **[3]**, **[0]**, **[0]**, **[k/m]** in the first column of Table 2-22. Table 2-22 lists the test settings at frequencies  $\geq 1$  MHz.
- r. Repeat steps 1-h through 1-m to remove the power splitter tracking characteristic. Record the 4395A marker reading and power meter reading in the “4395A Reading 2” and “Power Meter Reading 2” columns of the calculation sheet.
- s. Remove the power splitter from the A input, and connect it directly to the B input.
- t. Press **[Meas]**, **B** to set the 4395A to the B input.
- u. Press **[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN B**, **[1]**, **[0]**, **[x1]** to set the input attenuator to 10 dB.
- v. Press **[Bw/Avg]**, **RES BW**, **[3]**, **[0]**, **[0]**, **[k/m]** in the first column of Table 2-22. Table 2-22 lists the test settings at frequencies  $\geq 1$  MHz.

- w. Repeat steps 1-h through 1-m to remove the power splitter tracking characteristic. Record the 4395A marker reading and power meter reading in the “4395A Reading 2” and “Power Meter Reading 2” columns of the calculation sheet.
- x. Change the test equipment setup as shown in Figure 2-26.



**Figure 2-26. Frequency Response Test Setup 3**

■ **For testing low frequencies**

1. Initialize the function generator. Then set the amplitude to  $-20$  dBm.
2. On the function generator, set the frequency to the first test frequency 10 Hz in the first column of Table 2-23. Table 2-23 lists the test settings at frequencies  $< 1$  MHz.

**Table 2-23. Frequency Response Test Settings 2**

| Function Generator<br>Frequency | 4395A            |                |       |
|---------------------------------|------------------|----------------|-------|
|                                 | Center Frequency | Frequency Span | RBW   |
| 10 Hz                           | 10 Hz            | 15 Hz          | 1 Hz  |
| 15 Hz                           | 15 Hz            | 15 Hz          | 1 Hz  |
| 25 Hz                           | 25 Hz            | 15 Hz          | 1 Hz  |
| 40 Hz                           | 40 Hz            | 15 Hz          | 1 Hz  |
| 80 Hz                           | 80 Hz            | 15 Hz          | 1 Hz  |
| 100 Hz                          | 100 Hz           | 150 Hz         | 10 Hz |
| 200 Hz                          | 200 Hz           | 150 Hz         | 10 Hz |
| 500 Hz                          | 500 Hz           | 150 Hz         | 10 Hz |
| 1 kHz                           | 1 kHz            | 150 Hz         | 10 Hz |
| 2 kHz                           | 2 kHz            | 150 Hz         | 10 Hz |
| 5 kHz                           | 5 kHz            | 150 Hz         | 10 Hz |
| 10 kHz                          | 10 kHz           | 150 Hz         | 10 Hz |
| 20 kHz                          | 20 kHz           | 150 Hz         | 10 Hz |
| 50 kHz                          | 50 kHz           | 150 Hz         | 10 Hz |
| 100 kHz                         | 100 kHz          | 150 Hz         | 10 Hz |
| 200 kHz                         | 200 kHz          | 150 Hz         | 10 Hz |
| 500 kHz                         | 500 kHz          | 150 Hz         | 10 Hz |

3. On the 4395A, set the controls as follows (the first setting in Table 2-23):

**Control Settings**

Center Frequency: 10 Hz

Frequency Span: 10 Hz

RBW: 1 Hz

**Key Strokes**

**Center**, **1**, **0**, **x1**

**Span**, **1**, **0**, **x1**

**Bw/Avg**, **RES BW**, **1**, **x1**

4. Perform the following steps to measure the frequency response at frequencies < 1 MHz.
  - a. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - b. Press **Search**, **SEARCH: PEAK** to place the marker at the peak of the carrier.
  - c. Record the marker reading in the calculation sheet for frequencies < 1 MHz.
5. Change the function generator frequency, 4395A center frequency, span frequency and RBW in accordance with Table 2-23. Repeat step 4 for each setting:
6. Remove the BNC cable from the R input, and connect it to the A input.
7. Press **Meas**, **A** to set the 4395A to the A input.
8. Repeat steps 4 through 5 to measure the amplitude frequency response at the A input.
9. Remove the BNC cable from the A input, and connect it to the B input.
10. Press **Meas**, **B** to set the 4395A to the B input.
11. Repeat steps 4 through 5 to measure the amplitude frequency response at the A input.
12. Calculate the test results using the equation given in the calculation sheet. Record the test results in the performance test record.

---

# 18. SECOND HARMONIC DISTORTION TEST (SA)

## Description

This test measures the second harmonics level generated within the 4395A at a frequency of 50.1 MHz in the 4395A spectrum analyzer mode.

This test applies a 50.1 MHz CW frequency signal to the 4395A R input through a 50 MHz low pass filter (LPF). The LPF removes the second harmonics included in the applied signal. This ensures that the harmonics read by the 4395A are internally generated and not coming from the external signal source.

## Specification

|                                                            |                    |
|------------------------------------------------------------|--------------------|
| <b>Second harmonic distortion</b>                          |                    |
| @input signal freq. $\geq 100\text{ kHz}^1$                | $< -70\text{ dBc}$ |
| 1: single tone input with full scale input $-10\text{ dB}$ |                    |

## Test Equipment

|                                    |                              |
|------------------------------------|------------------------------|
| Signal Generator                   | 8642B                        |
| Power Meter                        | 436A Opt. 022, 437B, or 438A |
| Power Sensor                       | 8482A                        |
| 50 MHz Low Pass Filter             | PN 0955-0306                 |
| Two-Way Power Splitter             | 11667A                       |
| BNC cable, 61 cm (two required)    | PN 8120-1839                 |
| BNC cable, 122 cm                  | PN 8120-1839                 |
| BNC(f)-BNC(f) adapter              | PN 1250-0080                 |
| N(m)-N(m) adapter                  | PN 1250-1475                 |
| N(m)-BNC(f) adapter (two required) | PN 1250-0780                 |

## Procedure

1. Initialize the signal generator. Then set the signal generator controls as follows:

| Controls  | Settings         |
|-----------|------------------|
| Frequency | 50.1 MHz         |
| Amplitude | $-14\text{ dBm}$ |

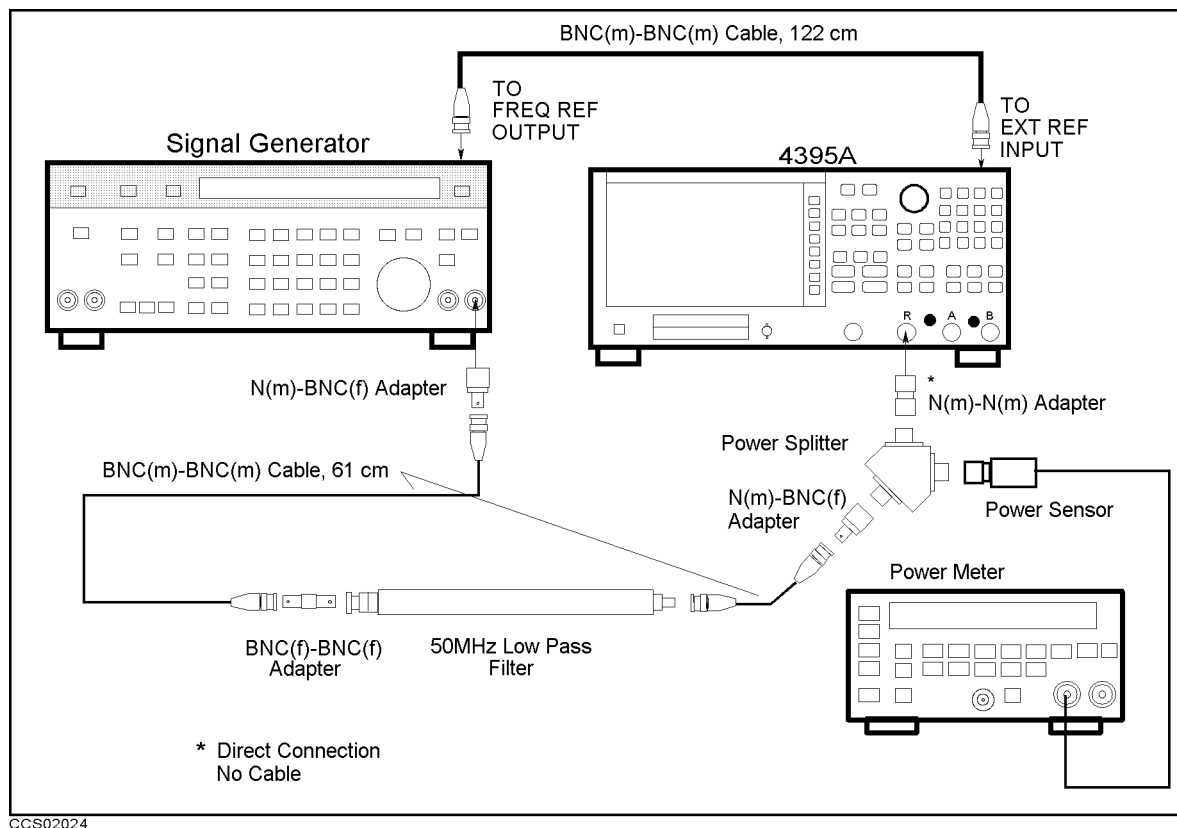
2. Connect the test equipment as shown in Figure 2-27.

---

|             |                                                                                                                                                                                                                                                                                          |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Note</b> | Connect the signal generator's 10 MHz frequency reference output to the 4395A EXT REF Input on the rear panel as shown in Figure 2-27. With this configuration, both the signal generator and the 4395A are phase locked to the same reference frequency to obtain a stable measurement. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

---





**Figure 2-27. Second Harmonics Distortion Test Setup**

- Press **[Meas]**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Input Port: R

Center Frequency: 50.1 MHz

Frequency Span: 17.935 kHz

RBW: 30 Hz

Reference Level: -10 dBm

Input Attenuator R: 10 dB

**Key Strokes**

**[Meas]** **R**

**[Center]**, **5**, **0**, **[.]**, **1**, **[M/μ]**

**[Span]**, **1**, **7**, **[.]**, **9**, **3**, **5**, **[k/m]**

**[Bw/Avg]**, **RES BW**, **3**, **0**, **[x1]**

**[Scale Ref]**, **REFERENCE VALUE**, **[-]**, **1**, **0**, **[x1]**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN R**, **1**, **0**, **[x1]**

- On the signal generator, adjust the amplitude until the power meter reads  $-20 \pm 0.1$  dBm.
- On the 4395A, press **[Trigger]**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
- Press **[Search]**, **MAX**, **[Marker]**, **ΔMODE MENU**, **FIXED ΔMKR** to place the delta marker reference at the peak of the carrier.
- Press **[Center]**, **1**, **0**, **[.]**, **2**, **[M/μ]** to set the 4395A center frequency to 100.2 MHz.
- Press **[Trigger]**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
- Press **[Search]**, **MAX** to move the delta marker to the peak of the second harmonic distortion. Record the delta marker reading in the performance test record ("Test Result" column).

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---

# 19. THIRD ORDER INTERMODULATION DISTORTION TEST (SA)

## Description

This test measures the spurious level generated by the 4395A's third order intermodulation distortion at 100.2 MHz.

In this test, two signals are combined in the directional bridge and applied to the 4395A's R input. A T/R test set is used as the directional bridge. The frequency of one signal is separated from the other with 200 kHz. This test measures the level of the spurious products that appear at a 200 kHz offset from the signals. The power level of the two signals is adjusted to -26 dBm. Therefore, each signal at the specified power level of -36 dBm is applied to the input mixer through the 4395A's 10 dB input attenuator.

## Specification

|                                                       |          |
|-------------------------------------------------------|----------|
| <b>Third order inter-modulation distortion</b>        |          |
| @separation $\geq$ 100kHz <sup>1</sup>                | <-70 dBc |
| 1: two tones input with full scale input level-16 dB, |          |

## Test Equipment

|                                      |                                 |
|--------------------------------------|---------------------------------|
| Signal Generator                     | 8663A                           |
| Signal Generator                     | 8642B                           |
| Power Meter                          | 436A Opt. 022, 437B, or 438A    |
| Power Sensor                         | 8482A                           |
| Two-Way Power Splitter               | 11667A                          |
| T/R Test Sets                        | 85044A                          |
| 50 $\Omega$ Termination              | 909C Opt. 012 or part of 85032B |
| Type-N Cable, 61 cm (three required) | 11500B or part of 11851B        |
| BNC cable, 122 cm (two required)     | PN 8120-1840                    |
| N(m)-N(m) adapter                    | PN 1250-1475                    |
| APC7.5-N(f) adapter                  | 11524A or part of 85032B        |
| Tee BNC(m)-(f)-(f) adapter           | PN 1250-0781                    |

## Procedure

1. Connect the test equipment as shown in Figure 2-28.

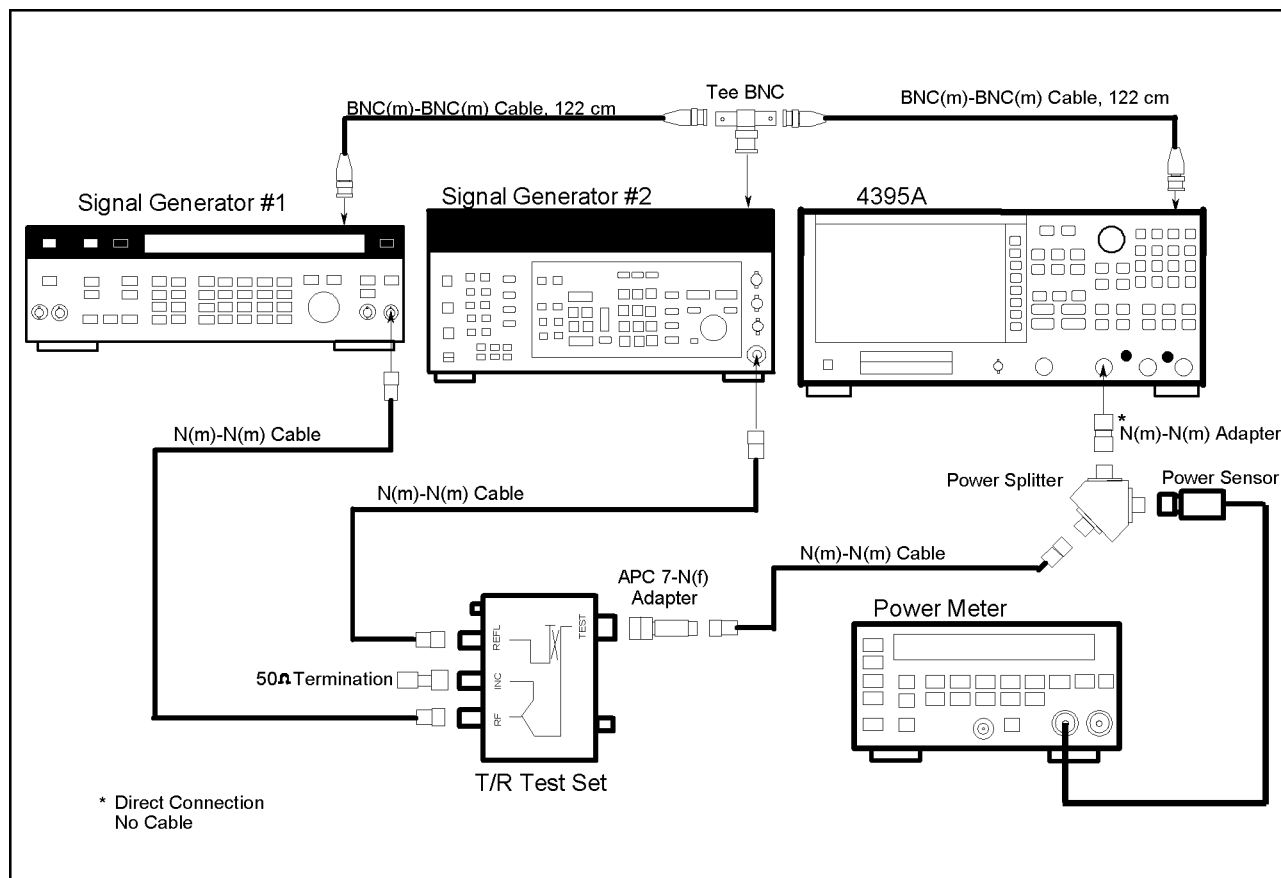
---

### Note



Connect the signal generator's 10 MHz frequency reference output to the 4395A EXT REF Input on the rear panel as shown in Figure 2-28. With this configuration, both the signal generator and the 4395A are phase locked to the same reference frequency to obtain a stable measurement.

---



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**Figure 2-28. Third Order Intermodulation Distortion Test Setup**

- Initialize both signal generators. Then set their controls as follows:

| Controls   | Settings |
|------------|----------|
| Modulation | OFF      |
| Amplitude  | -10 dBm  |
| RF Signal  | OFF      |

- Press **[Meas]**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

| Control Settings             | Key Strokes                                                                                    |
|------------------------------|------------------------------------------------------------------------------------------------|
| Input Port: R                | <b>[Meas]</b> <b>R</b>                                                                         |
| Center Frequency: 100.25 MHz | <b>[Center]</b> <b>1</b> , <b>0</b> , <b>0</b> , <b>.</b> , <b>2</b> , <b>5</b> , <b>[M/μ]</b> |
| Frequency Span: 400 kHz      | <b>[Span]</b> <b>4</b> , <b>0</b> , <b>0</b> , <b>[k/m]</b>                                    |
| RBW: 1 kHz                   | <b>[Bw/Avg]</b> <b>RES BW</b> , <b>1</b> , <b>[k/m]</b>                                        |
| Video BW: 1 kHz              | <b>[Bw/Avg]</b> <b>VIDEO BW</b> , <b>1</b> , <b>[k/m]</b>                                      |
| Reference Level: -10 dBm     | <b>[Scale Ref]</b> <b>REFERENCE VALUE</b> , <b>-</b> , <b>1</b> , <b>0</b> , <b>[x1]</b>       |
| Input Attenuator R: 10 dB    | <b>[Scale Ref]</b> <b>ATTENUATOR MENU</b> , <b>ATTEN R</b> , <b>1</b> , <b>0</b> , <b>[x1]</b> |

- On signal generator 1, set the frequency to 100.2 MHz.
- On signal generator 2, set the frequency to 100.3 MHz.

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6. On signal generators 1 and 2, perform the following steps to adjust each generator's signal amplitude to  $-20$  dBm.
  - a. On signal generator 1, turn the RF signal on and adjust the amplitude until the power meter reads  $-26$  dBm  $\pm 0.1$  dB.
  - b. On signal generator 1, turn the RF signal off.
  - c. On signal generator 2, turn the RF signal on and adjust the amplitude until the power meter reads  $-26$  dBm  $\pm 0.1$  dB.
  - d. On signal generator 1, turn the RF signal on.
7. On the 4395A, perform the following steps to measure the third order intermodulation distortion product.
  - a. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - b. Press **Marker**, **1**, **0**, **0**, **0**, **2**, **M/ $\mu$**  to move the marker to peak of the signal generator 1's signal.
  - c. Press **Marker**,  **$\Delta$ MODE MENU**, **FIXED  $\Delta$ MKR** to place the delta marker reference at the peak of one carrier.
  - d. Press **Marker**, **0**, **1**, **0**, **0**, **k/m** to move the marker to the third order intermodulation distortion products at the lower frequency.
  - e. Record the marker reading in the calculation sheet ("Lower Frequency" column).
  - f. Press **Marker**, **2**, **0**, **0**, **k/m** to move the marker to the third order intermodulation distortion product at the upper frequency.
  - g. Record the marker reading in the calculation sheet ("Upper Frequency" column).
  - h. Press **Marker**,  **$\Delta$ MODE MENU**,  **$\Delta$ MODE OFF**.
8. Compare the two marker readings at the lower and upper frequencies in the calculation sheet. Record the larger value in the performance test record ("Test Result" column).

---

## 20. OTHER SPURIOUS (SA)

### Description

This test measures the level of spurious signals generated by causes other than the second harmonic distortion and the third order intermodulation distortion.

This test applies several CW frequency signals to the 4395A R input and then measures the spurious signal level at a frequency range where the spurious signal is most likely to be observed.

### Specification

|                                                                                                                     |                          |
|---------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>Other spurious</b>                                                                                               |                          |
| @input signal freq. $\leq 500$ MHz .....                                                                            | $< -70$ dBc <sup>1</sup> |
| 1: single tone input with full scale input $-10$ dB, $RBW \leq 100$ kHz, $1$ kHz $\leq$ freq. offset $\leq 300$ MHz |                          |

### Test Equipment

|                           |                          |
|---------------------------|--------------------------|
| Signal Generator .....    | 8663A                    |
| Type-N Cable, 61 cm ..... | 11500B or part of 11851B |
| BNC cable, 122 cm .....   | PN 8120-1840             |

### Procedure

1. Connect the test equipment as shown in Figure 2-29.

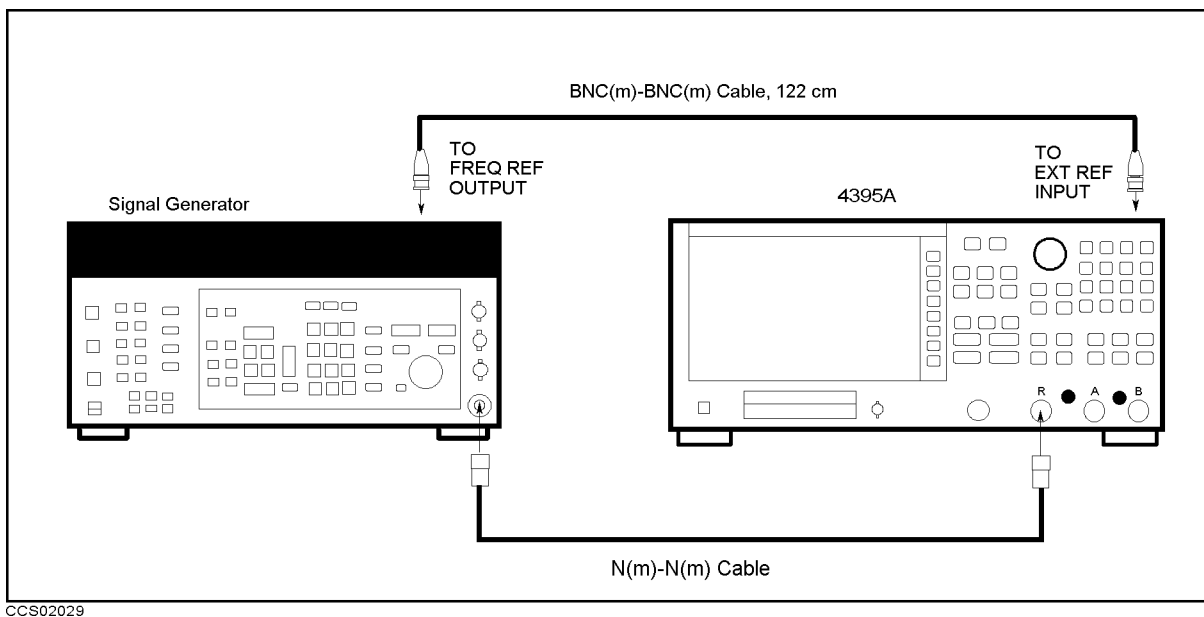
---

#### Note



Connect the signal generator's 10 MHz frequency reference output to the 4395A EXT REF Input on the rear panel as shown in Figure 2-29. With this configuration, both the signal generator and the 4395A are phase locked to the same reference frequency to obtain a stable measurement.

---



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**Figure 2-29. Other Spurious Test Setup**

- Press **[Meas]**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **[Preset]**, **[Meas]** **R** to initialize the 4395A.
- Initialize the signal generator. Then set the controls as follows.

| Controls | Settings |
|----------|----------|
| Power    | −30 dBm  |

- On the signal generator, set the frequency to 276.8666667 MHz (the first column of Table 2-24).

**Table 2-24. Other Spurious Test Settings**

| Signal Generator | 4395A            |                |        |        |                    |                 |
|------------------|------------------|----------------|--------|--------|--------------------|-----------------|
| Frequency        | Center Frequency | Frequency Span | RBW    | VBW    | Spurious Frequency | Reference Value |
| 276.8666667 MHz  | 300 MHz          | 17.95 kHz      | 100 Hz | 100 Hz | 300 MHz            | −30 dBm         |
| 16.3 MHz         | 1 MHz            | 17.95 kHz      | 100 Hz | 100 Hz | 1 MHz              | −30 dBm         |
| 212.8 MHz        | 210 MHz          | 17.95 kHz      | 100 Hz | 100 Hz | 210 MHz            | −30 dBm         |
| 205.9 MHz        | 210 MHz          | 17.95 kHz      | 100 Hz | 100 Hz | 210 MHz            | −30 dBm         |
| 213.7333333 MHz  | 210 MHz          | 17.95 kHz      | 100 Hz | 100 Hz | 210 MHz            | −30 dBm         |
| 209.1333333 MHz  | 210 MHz          | 17.95 kHz      | 100 Hz | 100 Hz | 210 MHz            | −30 dBm         |
| 6.897 MHz        | 6.897 MHz        | 17.94 kHz      | 30 Hz  | 30 Hz  | 6.900 MHz          | −30 dBm         |
| 6.897 MHz        | 6.897 MHz        | 17.94 kHz      | 30 Hz  | 30 Hz  | 6.903 MHz          | −30 dBm         |
| 256.897 MHz      | 256.897 MHz      | 17.94 kHz      | 30 Hz  | 30 Hz  | 256.900 MHz        | −30 dBm         |
| 256.897 MHz      | 256.897 MHz      | 17.94 kHz      | 30 Hz  | 30 Hz  | 256.903 MHz        | −30 dBm         |
| 494.397 MHz      | 494.397 MHz      | 17.94 kHz      | 30 Hz  | 30 Hz  | 494.400 MHz        | −30 dBm         |
| 494.397 MHz      | 494.397 MHz      | 17.94 kHz      | 30 Hz  | 30 Hz  | 494.403 MHz        | −30 dBm         |

5. On the 4395A, perform the following steps to measure the spurious level. In each step, the carrier level is measured first. Then the spurious level is measured.

- a. Set the controls as follows to measure the carries level:

**Control Settings**

Center Frequency: 276.8666667  
MHz

Frequency Span: 1 MHz

RBW: 3 kHz

**Key Strokes**

**Center**, **2**, **7**, **6**, **.**, **8**, **6**, **6**, **6**, **6**, **6**, **7**,

**M/μ**

**Span**, **1**, **M/μ**

**Bw/Avg**, **RES BW**, **3**, **k/m**

The center frequency is set to the frequency of the signal generator.

- b. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
- c. Press **Search**, **MAX**, **Marker**, **ΔMODE MENU**, **FIXED ΔMKR** to place the delta marker reference at the peak of the carrier.
- d. Set the following controls to the settings listed in Table 2-24 (from the second to the fifth columns):

**Control Settings**

Center Frequency: 300 MHz

Frequency Span: 17.95 kHz

RBW: 100 Hz

Video BW: 100 Hz

**Key Strokes**

**Center**, **3**, **0**, **0**, **M/μ**

**Span**, **1**, **7**, **.**, **9**, **5**, **k/m**

**Bw/Avg**, **RES BW**, **1**, **0**, **0**, **x1**

**Bw/Avg**, **VIDEO BW**, **1**, **0**, **0**, **x1**

- e. Press **Trigger**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - f. Press **Marker**, **ΔMODE MENU**, **ΔMKR SWP PARAM**, **3**, **0**, **0**, **M/μ** to move the delta reference marker to the spurious frequency in the seventh column of Table 2-24.
  - g. Press **Marker**, **0**, **x1**, to move the delta marker to the spurious frequency.
  - h. Record the 4395A marker reading in the performance test record ("Test Result" column).
6. Change the signal generator and 4395A controls in accordance with Table 2-24. Then repeat step 4 and 5 for each setting.

---

## 21. RESIDUAL RESPONSE TEST (SA)

### Description

This test connects a  $50\ \Omega$  terminator to the 4395A R input and measures the 4395A residual response at several frequencies where the response is most likely to be observed.

The residual response is any internally generated by mixing the harmonics of the first/second local phase-lock-loop oscillators and the related reference signal.

### Specification

#### Residual response

@reference value setting  $\leq -40$  dBm, input att.= auto or 0 dB .....  $< -108$  dBm

### Test Equipment

$50\ \Omega$  termination ..... 909C Opt. 012 or part of 85032B

### Procedure

1. Connect the test equipment as shown in Figure 2-30.

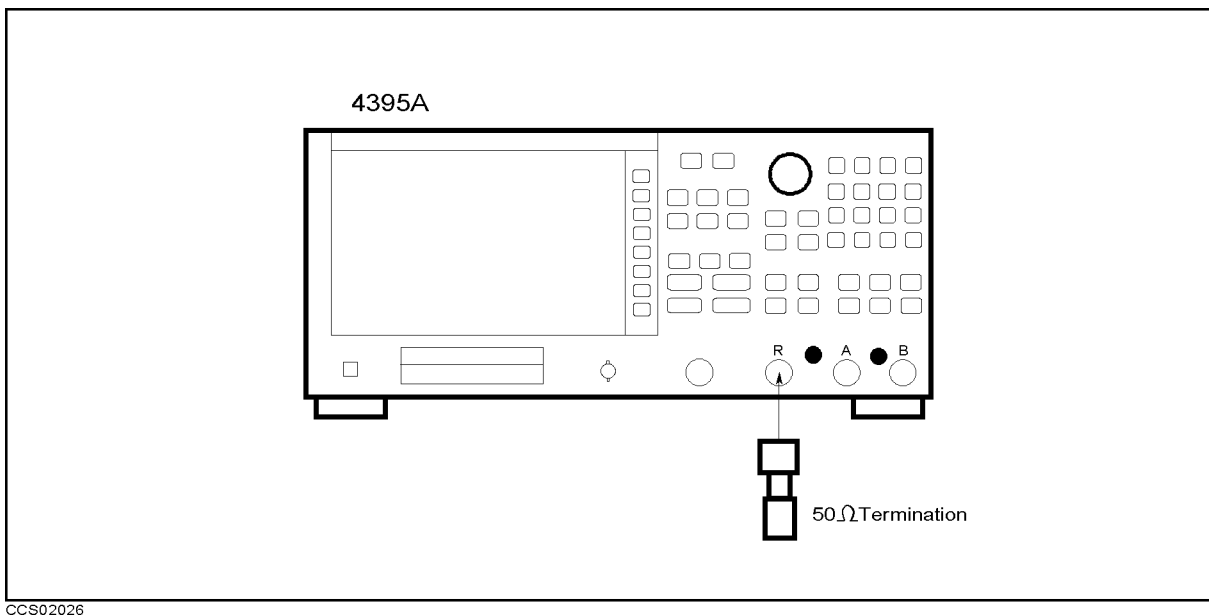


Figure 2-30. Residual Response Test Setup

2. Press **[Meas]**, **ANALYZER TYPE**, **SPECTRUM ANALYZER**, **[Preset]** to initialize the 4395A. Then set the controls as follows:

**Control Settings**

Input Port: R

Frequency Span: 2.24 kHz

RBW: 3 Hz

Reference Level: -50 dBm

Input Attenuator R: 0 dB;

**Key Strokes**

**[Meas]** **R**

**[Span]**, **[2]**, **[.]**, **[2]**, **[4]**, **[k/m]**

**[Bw/Avg]**, **RES BW**, **[3]**, **[x1]**

**[Scale Ref]**, **REFERENCE VALUE**, **[.]**, **[5]**, **[0]**, **[x1]**

**[Scale Ref]**, **ATTENUATOR MENU**, **ATTEN R**, **[0]**, **[x1]**

3. Set the center frequency to the first frequency 100.18333 MHz in Table 2-25.

**Table 2-25. Residual Response Test Settings**

| <b>4395A<br/>Center Frequency</b> |
|-----------------------------------|
| 100.18333 MHz                     |
| 166.85 MHz                        |
| 233.5166667 MHz                   |
| 366.85 MHz                        |
| 433.5166667 MHz                   |
| 161.75 MHz                        |
| 361.75 MHz                        |
| 377.05 MHz                        |
| 177.05 MHz                        |
| 438.6166667 MHz                   |
| 371.95 MHz                        |
| 238.6166667 MHz                   |
| 171.95 MHz                        |
| 105.2833333 MHz                   |

4. Perform the following steps to measure the residual response.
  - a. Press **[Trigger]**, **SINGLE** to make a sweep. Wait for the completion of the sweep.
  - b. Press **[Search]**, **MAX** to move the marker to the maximum point on the trace.
  - c. Record the marker reading in the performance test record “Test Result” column).
5. Change the 4395A center frequency in accordance with Table 2-25. Repeat step 4 for each setting.

## Calculation Sheet

---

### INTRODUCTION

This chapter contains calculation sheets for each performance test that requires additional calculations to determine the final test result.

Use the calculation sheet in this chapter as an aid for recording raw measurement data and calculating the performance test results.

Calculation sheet entries are provided only for performance tests in which calculations are required to obtain the test results.

---

## 2. SOURCE LEVEL ACCURACY/FLATNESS TEST

### Level Accuracy

| Frequency | Power Meter Reading<br>[ref <sup>1</sup> ] |
|-----------|--------------------------------------------|
|-----------|--------------------------------------------|

|        |           |
|--------|-----------|
| 50 MHz | _____ dBm |
|--------|-----------|

1 : is the power meter reading of the  
source level accuracy test.

**Level Flatness**

| Frequency | Power Meter Reading<br>[a] | Test Result<br>[a-ref] |
|-----------|----------------------------|------------------------|
| 10 Hz     | _____ dBm                  | _____ dB               |
| 50 Hz     | _____ dBm                  | _____ dB               |
| 500 Hz    | _____ dBm                  | _____ dB               |
| 2 kHz     | _____ dBm                  | _____ dB               |
| 12 kHz    | _____ dBm                  | _____ dB               |
| 60 kHz    | _____ dBm                  | _____ dB               |
| 150 kHz   | _____ dBm                  | _____ dB               |
| 1 MHz     | _____ dBm                  | _____ dB               |
| 3 MHz     | _____ dBm                  | _____ dB               |
| 10 MHz    | _____ dBm                  | _____ dB               |
| 45 MHz    | _____ dBm                  | _____ dB               |
| 75 MHz    | _____ dBm                  | _____ dB               |
| 110 MHz   | _____ dBm                  | _____ dB               |
| 140 MHz   | _____ dBm                  | _____ dB               |
| 190 MHz   | _____ dBm                  | _____ dB               |
| 235 MHz   | _____ dBm                  | _____ dB               |
| 290 MHz   | _____ dBm                  | _____ dB               |
| 345 MHz   | _____ dBm                  | _____ dB               |
| 400 MHz   | _____ dBm                  | _____ dB               |
| 445 MHz   | _____ dBm                  | _____ dB               |
| 470 MHz   | _____ dBm                  | _____ dB               |
| 500 MHz   | _____ dBm                  | _____ dB               |



---

### 3. NON-SWEEP POWER LINEARITY TEST

| Attenuation | Calibration Value <sup>1</sup> |
|-------------|--------------------------------|
| 10 dB       | <b>a1</b> = _____ dB           |
| 20 dB       | <b>a2</b> = _____ dB           |
| 30 dB       | <b>a3</b> = _____ dB           |
| 40 dB       | <b>a4</b> = _____ dB           |
| 50 dB       | <b>a5</b> = _____ dB           |

1 : Incremental attenuation referenced to 0 dB setting.

#### Reference (0 dBm)

| 4395A<br>Source Power | Power Meter Reading<br>[b] | Reference<br>[ref]      |
|-----------------------|----------------------------|-------------------------|
| 0 dBm                 | _____ dBm                  | <b>b+a3</b> = _____ dBm |

#### Non-Sweep Power Linearity

| 4395A<br>Source Power | Power Meter Reading<br>[b] | Test Result                   |
|-----------------------|----------------------------|-------------------------------|
| 15 dBm                | _____ dBm                  | <b>b+a5-ref-15</b> = _____ dB |
| 10 dBm                | _____ dBm                  | <b>b+a4-ref-10</b> = _____ dB |
| -10 dBm               | _____ dBm                  | <b>b+a2-ref+10</b> = _____ dB |
| -20 dBm               | _____ dBm                  | <b>b+a1-ref+20</b> = _____ dB |
| -30 dBm               | _____ dBm                  | <b>b+a1-ref+30</b> = _____ dB |
| -40 dBm               | _____ dBm                  | <b>b+a1-ref+40</b> = _____ dB |
| -50 dBm               | _____ dBm                  | <b>b+a1-ref+50</b> = _____ dB |

---

#### Note



Calculate **ref** in the calculation sheet for the reference (0 dBm) first. Then calculate test results using the equation and the value of **ref**.

---

---

## 4. POWER SWEEP LINEARITY TEST

| 4395A<br>Source Power | Power Meter Reading   |
|-----------------------|-----------------------|
| −50 dBm               | <b>a1</b> = _____ dBm |
| −45 dBm               | <b>a2</b> = _____ dBm |
| −40 dBm               | <b>a3</b> = _____ dBm |
| −35 dBm               | <b>a4</b> = _____ dBm |
| −30 dBm               | <b>a5</b> = _____ dBm |
| −5 dBm                | <b>b1</b> = _____ dBm |
| 0 dBm                 | <b>b2</b> = _____ dBm |
| 5 dBm                 | <b>b3</b> = _____ dBm |
| 10 dBm                | <b>b4</b> = _____ dBm |
| 15 dBm                | <b>b5</b> = _____ dBm |

| Stop Power | Source Power | Test Result                            |
|------------|--------------|----------------------------------------|
| −30 dBm    | −35 dBm      | <b>a4</b> −( <b>a5</b> −5) = _____ dB  |
|            | −40 dBm      | <b>a3</b> −( <b>a5</b> −10) = _____ dB |
|            | −45 dBm      | <b>a2</b> −( <b>a5</b> −15) = _____ dB |
|            | −50 dBm      | <b>a1</b> −( <b>a5</b> −20) = _____ dB |
| 15 dBm     | 10 dBm       | <b>b4</b> −( <b>b5</b> −5) = _____ dB  |
|            | 5 dBm        | <b>b3</b> −( <b>b5</b> −10) = _____ dB |
|            | 0 dBm        | <b>b2</b> −( <b>b5</b> −15) = _____ dB |
|            | −5 dBm       | <b>b1</b> −( <b>b5</b> −20) = _____ dB |

---

## 6. DC BIAS TEST (Option 001)

### DC Bias Voltage Level Accuracy

| 4395 A<br>DC Voltage | Multimeter Reading | Test Result    |
|----------------------|--------------------|----------------|
|                      | [a]                |                |
| −40 V                | _____ V            | a+40 = _____ V |
| −10 V                | _____ V            | a+10 = _____ V |
| −4 V                 | _____ V            | a+4 = _____ V  |
| 0 V                  | _____ V            | a+0 = _____ V  |
| 4 V                  | _____ V            | a−4 = _____ V  |
| 10 V                 | _____ V            | a−10 = _____ V |
| 40 V                 | _____ V            | a−40 = _____ V |

### DC Bias Current Level Accuracy

| 4395 A<br>DC Current | Multimeter Reading | Test Result      |
|----------------------|--------------------|------------------|
|                      | [a]                |                  |
| −100 mA              | _____ mA           | a+100 = _____ mA |
| −10 mA               | _____ mA           | a+10 = _____ mA  |
| −1 mA                | _____ mA           | a+1 = _____ mA   |
| −20 $\mu$ A          | _____ $\mu$ A      | a+20 = _____ mA  |
| 20 $\mu$ A           | _____ $\mu$ A      | a−20 = _____ mA  |
| 1 mA                 | _____ mA           | a−1 = _____ mA   |
| 10 mA                | _____ mA           | a−10 = _____ mA  |
| 100 mA               | _____ mA           | a−100 = _____ mA |

---

## 7. RECEIVER NOISE LEVEL TEST

| Frequency | Input | Trace Mean<br>[a] | Test Result<br>[ $20 \times \log(a)$ ] |
|-----------|-------|-------------------|----------------------------------------|
| 100 Hz    | R     | _____ Unit        | _____ dBm                              |
|           | A     | _____ Unit        | _____ dBm                              |
|           | B     | _____ Unit        | _____ dBm                              |
| 1 kHz     | R     | _____ Unit        | _____ dBm                              |
|           | A     | _____ Unit        | _____ dBm                              |
|           | B     | _____ Unit        | _____ dBm                              |
| 10 kHz    | R     | _____ Unit        | _____ dBm                              |
|           | A     | _____ Unit        | _____ dBm                              |
|           | B     | _____ Unit        | _____ dBm                              |
| 100 kHz   | R     | _____ Unit        | _____ dBm                              |
|           | A     | _____ Unit        | _____ dBm                              |
|           | B     | _____ Unit        | _____ dBm                              |
| 1 MHz     | R     | _____ Unit        | _____ dBm                              |
|           | A     | _____ Unit        | _____ dBm                              |
|           | B     | _____ Unit        | _____ dBm                              |
| 11 MHz    | R     | _____ Unit        | _____ dBm                              |
|           | A     | _____ Unit        | _____ dBm                              |
|           | B     | _____ Unit        | _____ dBm                              |
| 101 MHz   | R     | _____ Unit        | _____ dBm                              |
|           | A     | _____ Unit        | _____ dBm                              |
|           | B     | _____ Unit        | _____ dBm                              |
| 499 MHz   | R     | _____ Unit        | _____ dBm                              |
|           | A     | _____ Unit        | _____ dBm                              |
|           | B     | _____ Unit        | _____ dBm                              |

---

## 8. INPUT CROSSTALK TEST

**10 Hz  $\geq$  Freq. > 1 kHz**

| Measurement        | Marker Reading | Test Result   |
|--------------------|----------------|---------------|
|                    | [a]            |               |
| R into A Crosstalk | _____ dBm      | a-10 _____ dB |
| R into B Crosstalk | _____ dBm      | a-10 _____ dB |

**1 kHz  $\geq$  Freq. > 100 kHz**

| Measurement        | Marker Reading | Test Result   |
|--------------------|----------------|---------------|
|                    | [a]            |               |
| R into A Crosstalk | _____ dBm      | a-10 _____ dB |
| R into B Crosstalk | _____ dBm      | a-10 _____ dB |

**100 kHz  $\geq$  Freq.  $\geq$  500 kHz**

| Measurement        | Marker Reading | Test Result   |
|--------------------|----------------|---------------|
|                    | [a]            |               |
| R into A Crosstalk | _____ dBm      | a-10 _____ dB |
| R into B Crosstalk | _____ dBm      | a-10 _____ dB |

---

## 10. ABSOLUTE AMPLITUDE ACCURACY TEST

### Input R

| Frequency | 4395A Reading<br>[a] | Meter Reading<br>[b] | Test Result<br>[a–b] |
|-----------|----------------------|----------------------|----------------------|
| 100 Hz    | _____ dBm            | _____ dBm            | _____ dB             |
| 200 Hz    | _____ dBm            | _____ dBm            | _____ dB             |
| 500 Hz    | _____ dBm            | _____ dBm            | _____ dB             |
| 1 kHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 2 kHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 5 kHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 10 kHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 20 kHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 50 kHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 100 kHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 200 kHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 500 kHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 1 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 2 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 5 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 8 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 10 MHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 20 MHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 50 MHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 100 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 125 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 175 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 200 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 225 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 275 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 300 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 325 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 375 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 400 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 425 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 475 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 500 MHz   | _____ dBm            | _____ dBm            | _____ dB             |

## Input A

| Frequency | 4395A Reading<br>[a] | Meter Reading<br>[b] | Test Result<br>[a-b] |
|-----------|----------------------|----------------------|----------------------|
| 100 Hz    | _____ dBm            | _____ dBm            | _____ dB             |
| 200 Hz    | _____ dBm            | _____ dBm            | _____ dB             |
| 500 Hz    | _____ dBm            | _____ dBm            | _____ dB             |
| 1 kHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 2 kHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 5 kHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 10 kHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 20 kHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 50 kHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 100 kHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 200 kHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 500 kHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 1 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 2 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 5 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 8 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 10 MHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 20 MHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 50 MHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 100 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 125 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 175 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 200 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 225 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 275 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 300 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 325 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 375 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 400 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 425 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 475 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 500 MHz   | _____ dBm            | _____ dBm            | _____ dB             |

## Input B

| Frequency | 4395A Reading<br>[a] | Meter Reading<br>[b] | Test Result<br>[a-b] |
|-----------|----------------------|----------------------|----------------------|
| 100 Hz    | _____ dBm            | _____ dBm            | _____ dB             |
| 200 Hz    | _____ dBm            | _____ dBm            | _____ dB             |
| 500 Hz    | _____ dBm            | _____ dBm            | _____ dB             |
| 1 kHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 2 kHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 5 kHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 10 kHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 20 kHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 50 kHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 100 kHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 200 kHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 500 kHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 1 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 2 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 5 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 8 MHz     | _____ dBm            | _____ dBm            | _____ dB             |
| 10 MHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 20 MHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 50 MHz    | _____ dBm            | _____ dBm            | _____ dB             |
| 100 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 125 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 175 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 200 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 225 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 275 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 300 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 325 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 375 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 400 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 425 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 475 MHz   | _____ dBm            | _____ dBm            | _____ dB             |
| 500 MHz   | _____ dBm            | _____ dBm            | _____ dB             |



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## 11. MAGNITUDE RATIO/PHASE DYNAMIC ACCURACY TEST

### Step Attenuator Calibration Value at 50 MHz

| Attenuationg | Calibration Value <sup>1</sup> |
|--------------|--------------------------------|
| 10 dB        | a1 = _____ dB                  |
| 20 dB        | a2 = _____ dB                  |
| 30 dB        | a3 = _____ dB                  |
| 40 dB        | a4 = _____ dB                  |
| 50 dB        | a5 = _____ dB                  |
| 60 dB        | a6 = _____ dB                  |
| 70 dB        | a7 = _____ dB                  |
| 80 dB        | a8 = _____ dB                  |
| 90 dB        | a9 = _____ dB                  |
| 100 dB       | a10 = _____ dB                 |

1 : Incremental attenuation referenced to 0 dB setting.

### A/R Measurement

| Input Level | 4395A Reading<br>[b] | Test Result         |
|-------------|----------------------|---------------------|
| 0 dB        | _____ dB             | b-a1 = _____ dB     |
| -20 dB      | _____ dB             | b+a2-a1 = _____ dB  |
| -30 dB      | _____ dB             | b+a3-a1 = _____ dB  |
| -40 dB      | _____ dB             | b+a4-a1 = _____ dB  |
| -50 dB      | _____ dB             | b+a5-a1 = _____ dB  |
| -60 dB      | _____ dB             | b+a6-a1 = _____ dB  |
| -70 dB      | _____ dB             | b+a7-a1 = _____ dB  |
| -80 dB      | _____ dB             | b+a8-a1 = _____ dB  |
| -90 dB      | _____ dB             | b+a9-a1 = _____ dB  |
| -100 dB     | _____ dB             | b+a10-a1 = _____ dB |

### B/R Measurement

| Input Level | 4395A Reading<br>[b] | Test Result         |
|-------------|----------------------|---------------------|
| 0 dB        | _____ dB             | b-a1 = _____ dB     |
| -20 dB      | _____ dB             | b+a2-a1 = _____ dB  |
| -30 dB      | _____ dB             | b+a3-a1 = _____ dB  |
| -40 dB      | _____ dB             | b+a4-a1 = _____ dB  |
| -50 dB      | _____ dB             | b+a5-a1 = _____ dB  |
| -60 dB      | _____ dB             | b+a6-a1 = _____ dB  |
| -70 dB      | _____ dB             | b+a7-a1 = _____ dB  |
| -80 dB      | _____ dB             | b+a8-a1 = _____ dB  |
| -90 dB      | _____ dB             | b+a9-a1 = _____ dB  |
| -100 dB     | _____ dB             | b+a10-a1 = _____ dB |

## 13. DISPLAYED AVERAGE NOISE LEVEL TEST

### Input R

| Center<br>Frequency                                                              | Trace Mean<br>[a] | Test Result                                               |
|----------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------|
| 1 kHz                                                                            | _____ Watt        | $10 \times \log(a/0.001) - 4.8\text{dB}^1 =$ _____ dBm/Hz |
| 10 kHz                                                                           | _____ Watt        | $10 \times \log(a/0.001) - 10\text{dB}^2 =$ _____ dBm/Hz  |
| 100 kHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 10\text{dB}^2 =$ _____ dBm/Hz  |
| 1 MHz                                                                            | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 11 MHz                                                                           | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 20 MHz                                                                           | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 101 MHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 201 MHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 499 MHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 1 : $10 \times \text{LOG}(\text{RBW } 3 \text{ Hz} / \text{RBW } 1 \text{ Hz})$  |                   |                                                           |
| 2 : $10 \times \text{LOG}(\text{RBW } 10 \text{ Hz} / \text{RBW } 1 \text{ Hz})$ |                   |                                                           |
| 3 : $10 \times \text{LOG}(\text{RBW } 1 \text{ kHz} / \text{RBW } 1 \text{ Hz})$ |                   |                                                           |

### Input A

| Center<br>Frequency                                                              | Trace Mean<br>[a] | Test Result                                               |
|----------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------|
| 1 kHz                                                                            | _____ Watt        | $10 \times \log(a/0.001) - 4.8\text{dB}^1 =$ _____ dBm/Hz |
| 10 kHz                                                                           | _____ Watt        | $10 \times \log(a/0.001) - 10\text{dB}^2 =$ _____ dBm/Hz  |
| 100 kHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 10\text{dB}^2 =$ _____ dBm/Hz  |
| 1 MHz                                                                            | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 11 MHz                                                                           | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 20 MHz                                                                           | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 101 MHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 201 MHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 499 MHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 1 : $10 \times \text{LOG}(\text{RBW } 3 \text{ Hz} / \text{RBW } 1 \text{ Hz})$  |                   |                                                           |
| 2 : $10 \times \text{LOG}(\text{RBW } 10 \text{ Hz} / \text{RBW } 1 \text{ Hz})$ |                   |                                                           |
| 3 : $10 \times \text{LOG}(\text{RBW } 1 \text{ kHz} / \text{RBW } 1 \text{ Hz})$ |                   |                                                           |

## Input B

| Center<br>Frequency                                                              | Trace Mean<br>[a] | Test Result                                               |
|----------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------|
| 1 kHz                                                                            | _____ Watt        | $10 \times \log(a/0.001) - 4.8\text{dB}^1 =$ _____ dBm/Hz |
| 10 kHz                                                                           | _____ Watt        | $10 \times \log(a/0.001) - 10\text{dB}^2 =$ _____ dBm/Hz  |
| 100 kHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 10\text{dB}^2 =$ _____ dBm/Hz  |
| 1 MHz                                                                            | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 11 MHz                                                                           | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 20 MHz                                                                           | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 101 MHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 201 MHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 499 MHz                                                                          | _____ Watt        | $10 \times \log(a/0.001) - 30\text{dB}^3 =$ _____ dBm/Hz  |
| 1 : $10 \times \text{LOG}(\text{RBW } 3 \text{ Hz} / \text{RBW } 1 \text{ Hz})$  |                   |                                                           |
| 2 : $10 \times \text{LOG}(\text{RBW } 10 \text{ Hz} / \text{RBW } 1 \text{ Hz})$ |                   |                                                           |
| 3 : $10 \times \text{LOG}(\text{RBW } 1 \text{ kHz} / \text{RBW } 1 \text{ Hz})$ |                   |                                                           |

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## 14. AMPLITUDE FIDELITY

### Step Attenuator Calibration Value at 50 MHz

| Attenuation | Calibration Value <sup>1</sup> |
|-------------|--------------------------------|
| 10 dB       | <b>a1</b> = _____ dB           |
| 20 dB       | <b>a2</b> = _____ dB           |
| 30 dB       | <b>a3</b> = _____ dB           |
| 40 dB       | <b>a4</b> = _____ dB           |
| 50 dB       | <b>a5</b> = _____ dB           |
| 60 dB       | <b>a6</b> = _____ dB           |
| 70 dB       | <b>a7</b> = _____ dB           |
| 80 dB       | <b>a8</b> = _____ dB           |

1 : Incremental attenuation referenced to 0 dB setting.

### Amplitude Fidelity

#### Input R

| dB from<br>Reference Input Level | 4395A Reading<br>[b] | Test Result            |
|----------------------------------|----------------------|------------------------|
| –10 dB                           | _____ dB             | <b>b+a2-a1</b> = _____ |
| –20 dB                           | _____ dB             | <b>b+a3-a1</b> = _____ |
| –30 dB                           | _____ dB             | <b>b+a4-a1</b> = _____ |
| –40 dB                           | _____ dB             | <b>b+a5-a1</b> = _____ |
| –50 dB                           | _____ dB             | <b>b+a6-a1</b> = _____ |
| –60 dB                           | _____ dB             | <b>b+a7-a1</b> = _____ |
| –70 dB                           | _____ dB             | <b>b+a8-a1</b> = _____ |

#### Input A

| dB from<br>Reference Input Level | 4395A Reading<br>[b] | Test Result            |
|----------------------------------|----------------------|------------------------|
| –10 dB                           | _____ dB             | <b>b+a2-a1</b> = _____ |
| –20 dB                           | _____ dB             | <b>b+a3-a1</b> = _____ |
| –30 dB                           | _____ dB             | <b>b+a4-a1</b> = _____ |
| –40 dB                           | _____ dB             | <b>b+a5-a1</b> = _____ |
| –50 dB                           | _____ dB             | <b>b+a6-a1</b> = _____ |
| –60 dB                           | _____ dB             | <b>b+a7-a1</b> = _____ |
| –70 dB                           | _____ dB             | <b>b+a8-a1</b> = _____ |

**Input B**

| <b>dB from<br/>Reference Input Level</b> | <b>4395A Reading<br/>[b]</b> | <b>Test Result</b> |
|------------------------------------------|------------------------------|--------------------|
| −10 dB                                   | _____ dB                     | $b+a2-a1 =$ _____  |
| −20 dB                                   | _____ dB                     | $b+a3-a1 =$ _____  |
| −30 dB                                   | _____ dB                     | $b+a4-a1 =$ _____  |
| −40 dB                                   | _____ dB                     | $b+a5-a1 =$ _____  |
| −50 dB                                   | _____ dB                     | $b+a6-a1 =$ _____  |
| −60 dB                                   | _____ dB                     | $b+a7-a1 =$ _____  |
| −70 dB                                   | _____ dB                     | $b+a8-a1 =$ _____  |

**Input R**

| <b>dB from<br/>Reference Input Level</b> | <b>4395A Reading<br/>[b]</b> | <b>Test Result</b> |
|------------------------------------------|------------------------------|--------------------|
| 10 dB                                    | _____ dB                     | $b+a1-a2 =$ _____  |

**Input A**

| <b>dB from<br/>Reference Input Level</b> | <b>4395A Reading<br/>[b]</b> | <b>Test Result</b> |
|------------------------------------------|------------------------------|--------------------|
| 10 dB                                    | _____ dB                     | $b+a1-a2 =$ _____  |

**Input B**

| <b>dB from<br/>Reference Input Level</b> | <b>4395A Reading<br/>[b]</b> | <b>Test Result</b> |
|------------------------------------------|------------------------------|--------------------|
| 10 dB                                    | _____ dB                     | $b+a1-a2 =$ _____  |

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## 15. INPUT ATTENUATOR SWITCHING UNCERTAINTY TEST

### Step Attenuator Calibration Value at 50 MHz

| Attenuation | Calibration Value <sup>1</sup> |
|-------------|--------------------------------|
| 10 dB       | <b>a1</b> = _____ dB           |
| 20 dB       | <b>a2</b> = _____ dB           |
| 30 dB       | <b>a3</b> = _____ dB           |
| 40 dB       | <b>a4</b> = _____ dB           |
| 50 dB       | <b>a5</b> = _____ dB           |

1 : Incremental attenuation referenced to 0 dB setting.

### Input Attenuator Switching Uncertainty

#### Input R

| 4395A<br>Input Attenuation | 4395A Reading<br>[b] | Test Result            |
|----------------------------|----------------------|------------------------|
| 0 dB                       | _____ dB             | <b>b-a4+a5</b> = _____ |
| 20 dB                      | _____ dB             | <b>b-a4+a3</b> = _____ |
| 30 dB                      | _____ dB             | <b>b-a4+a2</b> = _____ |
| 40 dB                      | _____ dB             | <b>b-a4+a1</b> = _____ |
| 50 dB                      | _____ dB             | <b>b-a4</b> = _____    |

#### Input A

| 4395A<br>Input Attenuation | 4395A Reading<br>[b] | Test Result            |
|----------------------------|----------------------|------------------------|
| 0 dB                       | _____ dB             | <b>b-a4+a5</b> = _____ |
| 20 dB                      | _____ dB             | <b>b-a4+a3</b> = _____ |
| 30 dB                      | _____ dB             | <b>b-a4+a2</b> = _____ |
| 40 dB                      | _____ dB             | <b>b-a4+a1</b> = _____ |
| 50 dB                      | _____ dB             | <b>b-a4</b> = _____    |

## Input B

| 4395 A<br>Input Attenuation | 4395 A Reading<br>[b] | Test Result           |
|-----------------------------|-----------------------|-----------------------|
| 0 dB                        | _____ dB              | $b - a4 + a5 =$ _____ |
| 20 dB                       | _____ dB              | $b - a4 + a3 =$ _____ |
| 30 dB                       | _____ dB              | $b - a4 + a2 =$ _____ |
| 40 dB                       | _____ dB              | $b - a4 + a1 =$ _____ |
| 50 dB                       | _____ dB              | $b - a4 =$ _____      |

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## 17. AMPLITUDE ACCURACY/FREQUENCY RESPONSE TEST

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### Note



Calculate **ref** first in the table for the reference at 50 MHz. Then calculate test results using the equation and the value of **ref**.

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### Input R

#### Reference at 50 MHz

| 4395A<br>Frequency | 4395A<br>Reading 1<br>[r1] | Power Meter<br>Reading 1<br>[r2] | 4395A<br>Reading 2<br>[r3] | Power Meter<br>Reading 2<br>[r4] | Test Result<br>[ref]<br>[(r1-r2+r3-r4)/2] |
|--------------------|----------------------------|----------------------------------|----------------------------|----------------------------------|-------------------------------------------|
| 50 MHz             | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                                  |



# At Frequencies $\geq 1$ MHz

| 4395A<br>Frequency | 4395A<br>Reading 1<br>[a1] | Power Meter<br>Reading 1<br>[b1] | 4395A<br>Reading 2<br>[a2] | Power Meter<br>Reading 2<br>[b2] | Test Result<br>[(a1-b1+a2-b2)/2-ref] |
|--------------------|----------------------------|----------------------------------|----------------------------|----------------------------------|--------------------------------------|
| 1 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 2 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 5 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 8 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 10 MHz             | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 20 MHz             | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 100 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 125 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 150 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 175 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 200 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 225 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 250 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 275 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 300 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 325 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 350 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 375 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 400 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 425 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 450 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 475 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 500 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |

## At Frequencies < 1 MHz

| Frequency | 4395A Reading<br>[c] | Test Result<br>[c+20 dBm <sup>1</sup> -ref] |
|-----------|----------------------|---------------------------------------------|
| 10 Hz     | _____ dBm            | _____ dB                                    |
| 15 Hz     | _____ dBm            | _____ dB                                    |
| 25 Hz     | _____ dBm            | _____ dB                                    |
| 40 Hz     | _____ dBm            | _____ dB                                    |
| 80 Hz     | _____ dBm            | _____ dB                                    |
| 100 Hz    | _____ dBm            | _____ dB                                    |
| 200 Hz    | _____ dBm            | _____ dB                                    |
| 500 Hz    | _____ dBm            | _____ dB                                    |
| 1 kHz     | _____ dBm            | _____ dB                                    |
| 2 kHz     | _____ dBm            | _____ dB                                    |
| 5 kHz     | _____ dBm            | _____ dB                                    |
| 10 kHz    | _____ dBm            | _____ dB                                    |
| 20 kHz    | _____ dBm            | _____ dB                                    |
| 50 kHz    | _____ dBm            | _____ dB                                    |
| 100 kHz   | _____ dBm            | _____ dB                                    |
| 200 kHz   | _____ dBm            | _____ dB                                    |
| 500 kHz   | _____ dBm            | _____ dB                                    |

1 : is  $-(-20 \text{ dBm})$ .  $-20 \text{ dBm}$  is the output level of the function generator.

## Input A

### Reference at 50 MHz

| 4395A<br>Frequency | 4395A<br>Reading 1<br>[r1] | Power Meter<br>Reading 1<br>[r2] | 4395A<br>Reading 2<br>[r3] | Power Meter<br>Reading 2<br>[r4] | Test Result<br>[ref]<br>[(r1-r2+r3-r4)/2] |
|--------------------|----------------------------|----------------------------------|----------------------------|----------------------------------|-------------------------------------------|
| 50 MHz             | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                                  |

# At Frequencies $\geq 1$ MHz

| 4395A<br>Frequency | 4395A<br>Reading 1<br>[a1] | Power Meter<br>Reading 1<br>[b1] | 4395A<br>Reading 2<br>[a2] | Power Meter<br>Reading 2<br>[b2] | Test Result<br>[(a1-b1+a2-b2)/2-ref] |
|--------------------|----------------------------|----------------------------------|----------------------------|----------------------------------|--------------------------------------|
| 1 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 2 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 5 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 8 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 10 MHz             | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 20 MHz             | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 100 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 125 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 150 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 175 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 200 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 225 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 250 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 275 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 300 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 325 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 350 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 375 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 400 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 425 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 450 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 475 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 500 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |

## At Frequencies < 1 MHz

| Frequency | 4395 A Reading<br>[c] | Test Result<br>[c+20 dBm <sup>1</sup> -ref] |
|-----------|-----------------------|---------------------------------------------|
| 10 Hz     | _____ dBm             | _____ dB                                    |
| 15 Hz     | _____ dBm             | _____ dB                                    |
| 25 Hz     | _____ dBm             | _____ dB                                    |
| 40 Hz     | _____ dBm             | _____ dB                                    |
| 80 Hz     | _____ dBm             | _____ dB                                    |
| 100 Hz    | _____ dBm             | _____ dB                                    |
| 200 Hz    | _____ dBm             | _____ dB                                    |
| 500 Hz    | _____ dBm             | _____ dB                                    |
| 1 kHz     | _____ dBm             | _____ dB                                    |
| 2 kHz     | _____ dBm             | _____ dB                                    |
| 5 kHz     | _____ dBm             | _____ dB                                    |
| 10 kHz    | _____ dBm             | _____ dB                                    |
| 20 kHz    | _____ dBm             | _____ dB                                    |
| 50 kHz    | _____ dBm             | _____ dB                                    |
| 100 kHz   | _____ dBm             | _____ dB                                    |
| 200 kHz   | _____ dBm             | _____ dB                                    |
| 500 kHz   | _____ dBm             | _____ dB                                    |

1 : is  $-(-20 \text{ dBm})$ .  $-20 \text{ dBm}$  is the output level of the function generator.

## Input B

### Reference at 50 MHz

| 4395 A<br>Frequency | 4395 A<br>Reading 1<br>[r1] | Power Meter<br>Reading 1<br>[r2] | 4395 A<br>Reading 2<br>[r3] | Power Meter<br>Reading 2<br>[r4] | Test Result<br>[ref]<br>[(r1-r2+r3-r4)/2] |
|---------------------|-----------------------------|----------------------------------|-----------------------------|----------------------------------|-------------------------------------------|
| 50 MHz              | _____ dBm                   | _____ dBm                        | _____ dBm                   | _____ dBm                        | _____ dB                                  |

# At Frequencies $\geq 1$ MHz

| 4395A<br>Frequency | 4395A<br>Reading 1<br>[a1] | Power Meter<br>Reading 1<br>[b1] | 4395A<br>Reading 2<br>[a2] | Power Meter<br>Reading 2<br>[b2] | Test Result<br>[(a1-b1+a2-b2)/2-ref] |
|--------------------|----------------------------|----------------------------------|----------------------------|----------------------------------|--------------------------------------|
| 1 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 2 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 5 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 8 MHz              | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 10 MHz             | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 20 MHz             | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 100 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 125 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 150 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 175 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 200 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 225 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 250 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 275 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 300 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 325 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 350 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 375 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 400 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 425 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 450 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 475 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |
| 500 MHz            | _____ dBm                  | _____ dBm                        | _____ dBm                  | _____ dBm                        | _____ dB                             |

## At Frequencies < 1 MHz

| Frequency | 4395A Reading<br>[c] | Test Result<br>[c+20 dBm <sup>1</sup> -ref] |
|-----------|----------------------|---------------------------------------------|
| 10 Hz     | _____ dBm            | _____ dB                                    |
| 15 Hz     | _____ dBm            | _____ dB                                    |
| 25 Hz     | _____ dBm            | _____ dB                                    |
| 40 Hz     | _____ dBm            | _____ dB                                    |
| 80 Hz     | _____ dBm            | _____ dB                                    |
| 100 Hz    | _____ dBm            | _____ dB                                    |
| 200 Hz    | _____ dBm            | _____ dB                                    |
| 500 Hz    | _____ dBm            | _____ dB                                    |
| 1 kHz     | _____ dBm            | _____ dB                                    |
| 2 kHz     | _____ dBm            | _____ dB                                    |
| 5 kHz     | _____ dBm            | _____ dB                                    |
| 10 kHz    | _____ dBm            | _____ dB                                    |
| 20 kHz    | _____ dBm            | _____ dB                                    |
| 50 kHz    | _____ dBm            | _____ dB                                    |
| 100 kHz   | _____ dBm            | _____ dB                                    |
| 200 kHz   | _____ dBm            | _____ dB                                    |
| 500 kHz   | _____ dBm            | _____ dB                                    |

1 : is  $-(-20 \text{ dBm})$ .  $-20 \text{ dBm}$  is the output level of the function generator.

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## 18. THIRD ORDER HARMONIC DISTORTION TEST

| Frequency | 4395A Marker Reading |                 | Test Result         |
|-----------|----------------------|-----------------|---------------------|
|           | Lower Frequency      | Upper Frequency |                     |
|           | [a]                  | [b]             | [larger of a and b] |
| 100.2 MHz | _____ dBc            | _____ dBc       | _____ dBc           |

## Performance Test Record

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Agilent Technologies 4395A NETWORK/SPECTRUM/IMPEDANCE ANALYZER

Date: \_\_\_\_\_  
Temperature: \_\_\_\_\_  
Humidity: \_\_\_\_\_  
Serial No.: \_\_\_\_\_  
Tested by: \_\_\_\_\_

---

### 1. FREQUENCY ACCURACY TEST

#### without Option 1D5

| Frequency | Minimum<br>Limit | Test Result | Maximum<br>Limit | Measurement<br>Uncertainty |
|-----------|------------------|-------------|------------------|----------------------------|
| 100 MHz   | -550 Hz          | _____       | 550 Hz           | $\pm 34.6$ Hz              |

#### with Option 1D5

| Frequency | Minimum<br>Limit | Test Result | Maximum<br>Limit | Measurement<br>Uncertainty |
|-----------|------------------|-------------|------------------|----------------------------|
| 100 MHz   | -13 Hz           | _____       | 13 Hz            | $\pm 0.5$ Hz               |

---

## 2. SOURCE LEVEL ACCURACY/FLATNESS TEST

### Level Accuracy

| Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|---------------|-------------|---------------|-------------------------|
| -1.0 dB       | _____       | 1.0 dB        | ±0.12 dB                |

### Level Flatness

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|-----------|---------------|-------------|---------------|-------------------------|
| 10 Hz     | -2.0 dB       | _____       | 2.0 dB        | ±0.12 dB                |
| 50 Hz     | -2.0 dB       | _____       | 2.0 dB        | ±0.12 dB                |
| 500 Hz    | -2.0 dB       | _____       | 2.0 dB        | ±0.12 dB                |
| 2 kHz     | -2.0 dB       | _____       | 2.0 dB        | ±0.12 dB                |
| 12 kHz    | -2.0 dB       | _____       | 2.0 dB        | ±0.12 dB                |
| 60 kHz    | -2.0 dB       | _____       | 2.0 dB        | ±0.12 dB                |
| 160 kHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.12 dB                |
| 500 kHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.13 dB                |
| 1 MHz     | -2.0 dB       | _____       | 2.0 dB        | ±0.15 dB                |
| 3 MHz     | -2.0 dB       | _____       | 2.0 dB        | ±0.15 dB                |
| 10 MHz    | -2.0 dB       | _____       | 2.0 dB        | ±0.15 dB                |
| 45 MHz    | -2.0 dB       | _____       | 2.0 dB        | ±0.15 dB                |
| 75 MHz    | -2.0 dB       | _____       | 2.0 dB        | ±0.15 dB                |
| 110 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.15 dB                |
| 140 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.15 dB                |
| 190 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.15 dB                |
| 235 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.37 dB                |
| 290 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.37 dB                |
| 345 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.37 dB                |
| 400 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.37 dB                |
| 445 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.37 dB                |
| 470 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.37 dB                |
| 500 MHz   | -2.0 dB       | _____       | 2.0 dB        | ±0.37 dB                |



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### 3. NON SWEEP POWER LINEARITY TEST

| Power Setting | Minimum<br>Limit | Test Result | Maximum<br>Limit | Measurement<br>Uncertainty |
|---------------|------------------|-------------|------------------|----------------------------|
| 15 dBm        | -1.0 dB          | _____       | 1.0 dB           | ±0.056 dB                  |
| 10 dBm        | -1.0 dB          | _____       | 1.0 dB           | ±0.056 dB                  |
| -10 dBm       | -1.0 dB          | _____       | 1.0 dB           | ±0.057 dB                  |
| -20 dBm       | -1.0 dB          | _____       | 1.0 dB           | ±0.065 dB                  |
| -30 dBm       | -1.0 dB          | _____       | 1.0 dB           | ±0.078 dB                  |
| -40 dBm       | -1.0 dB          | _____       | 1.0 dB           | ±0.078 dB                  |
| -50 dBm       | -1.5 dB          | _____       | 1.5 dB           | ±0.082 dB                  |

---

### 4. POWER SWEEP LINEARITY TEST

| STOP Power | Source<br>Power | Minimum<br>Limit | Test Result | Maximum<br>Limit | Measurement<br>Uncertainty |
|------------|-----------------|------------------|-------------|------------------|----------------------------|
| -30 dBm    | -35 dBm         | -0.5 dB          | _____       | 0.5 dB           | ±0.095 dB                  |
|            | -40 dBm         | -0.5 dB          | _____       | 0.5 dB           | ±0.095 dB                  |
|            | -45 dBm         | -0.5 dB          | _____       | 0.5 dB           | ±0.095 dB                  |
|            | -50 dBm         | -0.5 dB          | _____       | 0.5 dB           | ±0.095 dB                  |
| 15 dBm     | 10 dBm          | -0.5 dB          | _____       | 0.5 dB           | ±0.071 dB                  |
|            | 5 dBm           | -0.5 dB          | _____       | 0.5 dB           | ±0.071 dB                  |
|            | 0 dBm           | -0.5 dB          | _____       | 0.5 dB           | ±0.071 dB                  |
|            | -5 dBm          | -0.5 dB          | _____       | 0.5 dB           | ±0.071 dB                  |

---

## 5. HARMONICS/NON-HARMONIC SPURIOUS TEST

### Harmonics

| Frequency | Harmonics Frequency | Test Result | Test Limit | Measurement Uncertainty |
|-----------|---------------------|-------------|------------|-------------------------|
| 10 kHz    | 20 kHz              | _____       | < -30 dBc  | ±1.68 dB                |
|           | 30 kHz              | _____       | < -30 dBc  | ±1.66 dB                |
| 500 kHz   | 1 MHz               | _____       | < -30 dBc  | ±1.68 dB                |
|           | 1.5 MHz             | _____       | < -30 dBc  | ±1.66 dB                |
| 10 MHz    | 20 MHz              | _____       | < -30 dBc  | ±1.65 dB                |
|           | 30 MHz              | _____       | < -30 dBc  | ±1.65 dB                |
| 100 MHz   | 200 MHz             | _____       | < -30 dBc  | ±1.65 dB                |
|           | 300 MHz             | _____       | < -30 dBc  | ±1.65 dB                |
| 250 MHz   | 500 MHz             | _____       | < -30 dBc  | ±3.53 dB                |
|           | 750 MHz             | _____       | < -30 dBc  | ±3.53 dB                |
| 500 MHz   | 1 GHz               | _____       | < -30 dBc  | ±3.53 dB                |
|           | 1.5 GHz             | _____       | < -30 dBc  | ±3.53 dB                |

### Non-Harmonic Spurious

| Frequency | Non-Harmonic Frequency | Test Result | Test Limit | Measurement Uncertainty |
|-----------|------------------------|-------------|------------|-------------------------|
| 10 Hz     | 830.00001 MHz          | _____       | < -30 dBc  | ±3.53 dB                |
| 230 MHz   | 600 MHz                | _____       | < -30 dBc  | ±3.53 dB                |
| 330 MHz   | 500 MHz                | _____       | < -30 dBc  | ±3.53 dB                |
| 430 MHz   | 400 MHz                | _____       | < -30 dBc  | ±3.53 dB                |
| 500 MHz   | 330 MHz                | _____       | < -30 dBc  | ±3.53 dB                |

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## 6. DC BIAS ACCURACY TEST

| DC Bias | Test Result | Test Limit    | Measurement Uncertainty |
|---------|-------------|---------------|-------------------------|
| -40 V   | _____       | < $\pm 44$ mV | $\pm 0.853$ mV          |
| -10 V   | _____       | < $\pm 14$ mV | $\pm 0.378$ mV          |
| -4 V    | _____       | < $\pm 8$ mV  | $\pm 0.056$ mV          |
| 0 V     | _____       | < $\pm 4$ mV  | $\pm 0.023$ mV          |
| 4 V     | _____       | < $\pm 8$ mV  | $\pm 0.056$ mV          |
| 10 V    | _____       | < $\pm 14$ mV | $\pm 0.378$ mV          |
| 40 V    | _____       | < $\pm 44$ mV | $\pm 0.853$ mV          |

| DC Bias     | Test Result | Test Limit       | Measurement Uncertainty |
|-------------|-------------|------------------|-------------------------|
| -100 mA     | _____       | < $\pm 0.530$ mA | $\pm 0.163$ mA          |
| -10 mA      | _____       | < $\pm 0.080$ mA | $\pm 1.63$ $\mu$ A      |
| -1 mA       | _____       | < $\pm 0.035$ mA | $\pm 0.163$ $\mu$ A     |
| -20 $\mu$ A | _____       | < $\pm 0.035$ mA | $\pm 0.072$ $\mu$ A     |
| 20 $\mu$ A  | _____       | < $\pm 0.035$ mA | $\pm 0.072$ $\mu$ A     |
| 1 mA        | _____       | < $\pm 0.035$ mA | $\pm 0.163$ $\mu$ A     |
| 10 mA       | _____       | < $\pm 0.080$ mA | $\pm 1.63$ $\mu$ A      |
| 100 mA      | _____       | < $\pm 0.530$ mA | $\pm 0.163$ mA          |

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## 7. RECEIVER NOISE LEVEL TEST

| Frequency | Input | Test Result | Test Limit   |
|-----------|-------|-------------|--------------|
| 100 Hz    | R     | _____       | < -85 dBm    |
|           | A     | _____       | < -85 dBm    |
|           | B     | _____       | < -85 dBm    |
| 1 kHz     | R     | _____       | < -85 dBm    |
|           | A     | _____       | < -85 dBm    |
|           | B     | _____       | < -85 dBm    |
| 10 kHz    | R     | _____       | < -85 dBm    |
|           | A     | _____       | < -85 dBm    |
|           | B     | _____       | < -85 dBm    |
| 100 kHz   | R     | _____       | < -115.0 dBm |
|           | A     | _____       | < -115.0 dBm |
|           | B     | _____       | < -115.0 dBm |
| 1 MHz     | R     | _____       | < -115.0 dBm |
|           | A     | _____       | < -115.0 dBm |
|           | B     | _____       | < -115.0 dBm |
| 11 MHz    | R     | _____       | < -114.9 dBm |
|           | A     | _____       | < -114.9 dBm |
|           | B     | _____       | < -114.9 dBm |
| 101 MHz   | R     | _____       | < -114.0 dBm |
|           | A     | _____       | < -114.0 dBm |
|           | B     | _____       | < -114.0 dBm |
| 499 MHz   | R     | _____       | < -110.5 dBm |
|           | A     | _____       | < -110.5 dBm |
|           | B     | _____       | < -110.5 dBm |

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## 8. INPUT CROSSTALK TEST

**10 Hz  $\leq$  Freq.  $<$  1 kHz**

| Measurement        | Test Result | Test Limit  |
|--------------------|-------------|-------------|
| R into A Crosstalk | _____       | $< -100$ dB |
| R into B Crosstalk | _____       | $< -100$ dB |

**1 kHz  $\leq$  Freq.  $<$  100 kHz**

| Measurement        | Test Result | Test Limit  |
|--------------------|-------------|-------------|
| R into A Crosstalk | _____       | $< -100$ dB |
| R into B Crosstalk | _____       | $< -100$ dB |

**100 kHz  $\leq$  Freq.  $\leq$  500 MHz**

| Measurement        | Test Result | Test Limit  |
|--------------------|-------------|-------------|
| R into A Crosstalk | _____       | $< -120$ dB |
| R into B Crosstalk | _____       | $< -120$ dB |

---

## 9. INPUT IMPEDANCE TEST

**100 kHz  $\leq$  Freq.  $\leq$  100 MHz**

| Measurement   | Test Result | Test Limit | Measurement<br>Uncertainty |
|---------------|-------------|------------|----------------------------|
| R Return Loss | _____       | $< -25$ dB | $\pm 3.16$ dB              |
| A Return Loss | _____       | $< -25$ dB | $\pm 3.16$ dB              |
| B Return Loss | _____       | $< -25$ dB | $\pm 3.16$ dB              |

**100 MHz  $<$  Freq.  $\leq$  500 MHz**

| Measurement   | Test Result | Test Limit | Measurement<br>Uncertainty |
|---------------|-------------|------------|----------------------------|
| R Return Loss | _____       | $< -15$ dB | $\pm 3.16$ dB              |
| A Return Loss | _____       | $< -15$ dB | $\pm 3.16$ dB              |
| B Return Loss | _____       | $< -15$ dB | $\pm 3.16$ dB              |

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## 10. ABSOLUTE AMPLITUDE ACCURACY TEST

### Input R

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|-----------|---------------|-------------|---------------|-------------------------|
| 100 Hz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 200 Hz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 500 Hz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 1 kHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 2 kHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 5 kHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 10 kHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 20 kHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 50 kHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 100 kHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 200 kHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 500 kHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.18 dB                |
| 1 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 2 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 5 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 8 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 10 MHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 20 MHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 50 MHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 100 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.21 dB                |
| 125 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 175 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 200 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 225 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 275 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 300 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 325 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 375 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 400 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 425 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 475 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 500 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |

## Input A

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|-----------|---------------|-------------|---------------|-------------------------|
| 100 Hz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 200 Hz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 500 Hz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 1 kHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 2 kHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 5 kHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 10 kHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 20 kHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 50 kHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 100 kHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 200 kHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 500 kHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.18 dB                |
| 1 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 2 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 5 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 8 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 10 MHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 20 MHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 50 MHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 100 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.21 dB                |
| 125 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 175 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 200 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 225 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 275 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 300 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 325 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 375 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 400 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 425 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 475 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 500 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |

## Input B

| Frequency | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|-----------|---------------|-------------|---------------|-------------------------|
| 100 Hz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 200 Hz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 500 Hz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 1 kHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 2 kHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 5 kHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 10 kHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 20 kHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 50 kHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 100 kHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 200 kHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.17 dB                |
| 500 kHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.18 dB                |
| 1 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 2 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 5 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 8 MHz     | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 10 MHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 20 MHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 50 MHz    | -1.5 dB       | _____       | 1.5 dB        | ±0.20 dB                |
| 100 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.21 dB                |
| 125 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 175 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 200 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 225 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 275 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 300 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 325 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 375 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 400 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 425 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 475 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |
| 500 MHz   | -1.5 dB       | _____       | 1.5 dB        | ±0.23 dB                |



## 11. MAGNITUDE RATIO/PHASE DYNAMIC ACCURACY TEST

### A/R Measurement

| Input Level <sup>1</sup> | Measurement     | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|--------------------------|-----------------|---------------|-------------|---------------|-------------------------|
| 0 dB                     | Magnitude Ratio | -0.40 dB      | _____       | 0.40 dB       | ±0.0120 dB              |
|                          | Phase           | -3.0°         | _____       | 3.0°          | ±0.0665°                |
| -20 dB                   | Magnitude Ratio | -0.05 dB      | _____       | 0.05 dB       | ±0.0100 dB              |
|                          | Phase           | -0.3°         | _____       | 0.3°          | ±0.0664°                |
| -30 dB                   | Magnitude Ratio | -0.05 dB      | _____       | 0.05 dB       | ±0.0101 dB              |
|                          | Phase           | -0.3°         | _____       | 0.3°          | ±0.0664°                |
| -40 dB                   | Magnitude Ratio | -0.05 dB      | _____       | 0.05 dB       | ±0.0109 dB              |
|                          | Phase           | -0.3°         | _____       | 0.3°          | ±0.0664°                |
| -50 dB                   | Magnitude Ratio | -0.05 dB      | _____       | 0.05 dB       | ±0.0127 dB              |
|                          | Phase           | -0.3°         | _____       | 0.3°          | ±0.0664°                |
| -60 dB                   | Magnitude Ratio | -0.05 dB      | _____       | 0.05 dB       | ±0.0135 dB              |
|                          | Phase           | -0.3°         | _____       | 0.3°          | ±0.0664°                |
| -70 dB                   | Magnitude Ratio | -0.3 dB       | _____       | 0.3 dB        | ±0.0238 dB              |
|                          | Phase           | -1.8°         | _____       | 1.8°          | ±0.0664°                |
| -80 dB                   | Magnitude Ratio | -0.3 dB       | _____       | 0.3 dB        | ±0.0178 dB              |
|                          | Phase           | -1.8°         | _____       | 1.8°          | ±0.0664°                |
| -90 dB                   | Magnitude Ratio | -3.0 dB       | _____       | 3.0 dB        | ±0.0374 dB              |
|                          | Phase           | -18°          | _____       | 18°           | ±0.0664°                |
| -100 dB                  | Magnitude Ratio | -3.0 dB       | _____       | 3.0 dB        | ±0.0575 dB              |
|                          | Phase           | -18°          | _____       | 18°           | ±0.0664°                |

<sup>1</sup> Relative to full scale input level

## B/R Measurement

| Input Level <sup>1</sup> | Measurement     | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|--------------------------|-----------------|---------------|-------------|---------------|-------------------------|
| 0 dB                     | Magnitude Ratio | −0.40 dB      | _____       | 0.40 dB       | ±0.0120 dB              |
|                          | Phase           | −3.0°         | _____       | 3.0°          | ±0.0665°                |
| −20 dB                   | Magnitude Ratio | −0.05 dB      | _____       | 0.05 dB       | ±0.0100 dB              |
|                          | Phase           | −0.3°         | _____       | 0.3°          | ±0.0664°                |
| −30 dB                   | Magnitude Ratio | −0.05 dB      | _____       | 0.05 dB       | ±0.0101 dB              |
|                          | Phase           | −0.3°         | _____       | 0.3°          | ±0.0664°                |
| −40 dB                   | Magnitude Ratio | −0.05 dB      | _____       | 0.05 dB       | ±0.0109 dB              |
|                          | Phase           | −0.3°         | _____       | 0.3°          | ±0.0664°                |
| −50 dB                   | Magnitude Ratio | −0.05 dB      | _____       | 0.05 dB       | ±0.0127 dB              |
|                          | Phase           | −0.3°         | _____       | 0.3°          | ±0.0664°                |
| −60 dB                   | Magnitude Ratio | −0.05 dB      | _____       | 0.05 dB       | ±0.0135 dB              |
|                          | Phase           | −0.3°         | _____       | 0.3°          | ±0.0664°                |
| −70 dB                   | Magnitude Ratio | −0.3 dB       | _____       | 0.3 dB        | ±0.0238 dB              |
|                          | Phase           | −1.8°         | _____       | 1.8°          | ±0.0664°                |
| −80 dB                   | Magnitude Ratio | −0.3 dB       | _____       | 0.3 dB        | ±0.0178 dB              |
|                          | Phase           | −1.8°         | _____       | 1.8°          | ±0.0664°                |
| −90 dB                   | Magnitude Ratio | −3.0 dB       | _____       | 3.0 dB        | ±0.0374 dB              |
|                          | Phase           | −18°          | _____       | 18°           | ±0.0664°                |
| −100 dB                  | Magnitude Ratio | −3.0 dB       | _____       | 3.0 dB        | ±0.0575 dB              |
|                          | Phase           | −18°          | _____       | 18°           | ±0.0664°                |

<sup>1</sup> Relative to full scale input level

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## 12. MAGNITUDE RATIO/PHASE FREQUENCY RESPONSE TEST

### A/R Measurement

| Measurement     | Minimum<br>Limit | Test Result | Maximum<br>Limit |
|-----------------|------------------|-------------|------------------|
| Magnitude Ratio | -2 dB            | _____       | 2 dB             |
| Phase           | -12°             | _____       | 12°              |

### B/R Measurement

| Measurement     | Minimum<br>Limit | Test Result | Maximum<br>Limit |
|-----------------|------------------|-------------|------------------|
| Magnitude Ratio | -2 dB            | _____       | 2 dB             |
| Phase           | -12°             | _____       | 12°              |

---

## 13. DISPLAYED AVERAGE NOISE LEVEL TEST

### Input R

| Frequency | Test Result | Test Limit    |
|-----------|-------------|---------------|
| 1 kHz     | _____       | < -120 dBm/Hz |
| 10 kHz    | _____       | < -120 dBm/Hz |
| 100 kHz   | _____       | < -133 dBm/Hz |
| 1 MHz     | _____       | < -133 dBm/Hz |
| 11 MHz    | _____       | < -145 dBm/Hz |
| 20 MHz    | _____       | < -145 dBm/Hz |
| 101 MHz   | _____       | < -144 dBm/Hz |
| 201 MHz   | _____       | < -143 dBm/Hz |
| 499 MHz   | _____       | < -140 dBm/Hz |

## Input A

| Frequency | Test Result | Test Limit    |
|-----------|-------------|---------------|
| 1 kHz     | _____       | < -120 dBm/Hz |
| 10 kHz    | _____       | < -120 dBm/Hz |
| 100 kHz   | _____       | < -133 dBm/Hz |
| 1 MHz     | _____       | < -133 dBm/Hz |
| 11 MHz    | _____       | < -145 dBm/Hz |
| 20 MHz    | _____       | < -145 dBm/Hz |
| 101 MHz   | _____       | < -144 dBm/Hz |
| 201 MHz   | _____       | < -143 dBm/Hz |
| 499 MHz   | _____       | < -140 dBm/Hz |

## Input B

| Frequency | Test Result | Test Limit    |
|-----------|-------------|---------------|
| 1 kHz     | _____       | < -120 dBm/Hz |
| 10 kHz    | _____       | < -120 dBm/Hz |
| 100 kHz   | _____       | < -133 dBm/Hz |
| 1 MHz     | _____       | < -133 dBm/Hz |
| 11 MHz    | _____       | < -145 dBm/Hz |
| 20 MHz    | _____       | < -145 dBm/Hz |
| 101 MHz   | _____       | < -144 dBm/Hz |
| 201 MHz   | _____       | < -143 dBm/Hz |
| 499 MHz   | _____       | < -140 dBm/Hz |

---

## 14. AMPLITUDE FIDELITY TEST

## Input R

| dB from<br>Reference Input Level | Minimum Limit | Test Result | Maximum Limit | Measurement<br>Uncertainty |
|----------------------------------|---------------|-------------|---------------|----------------------------|
| 10 dB                            | −0.05 dB      | _____       | 0.05 dB       | ±0.011 dB                  |
| −10 dB                           | −0.05 dB      | _____       | 0.05 dB       | ±0.011 dB                  |
| −20 dB                           | −0.05 dB      | _____       | 0.05 dB       | ±0.012 dB                  |
| −30 dB                           | −0.07 dB      | _____       | 0.07 dB       | ±0.012 dB                  |
| −40 dB                           | −0.15 dB      | _____       | 0.15 dB       | ±0.014 dB                  |
| −50 dB                           | −0.35 dB      | _____       | 0.35 dB       | ±0.015 dB                  |
| −60 dB                           | −0.8 dB       | _____       | 0.8 dB        | ±0.024 dB                  |
| −70 dB                           | −1.8 dB       | _____       | 1.8 dB        | ±0.037 dB                  |

## Input A

| dB from<br>Reference Input Level | Minimum Limit | Test Result | Maximum Limit | Measurement<br>Uncertainty |
|----------------------------------|---------------|-------------|---------------|----------------------------|
| 10 dB                            | −0.05 dB      | _____       | 0.05 dB       | ±0.011 dB                  |
| −10 dB                           | −0.05 dB      | _____       | 0.05 dB       | ±0.011 dB                  |
| −20 dB                           | −0.05 dB      | _____       | 0.05 dB       | ±0.012 dB                  |
| −30 dB                           | −0.07 dB      | _____       | 0.07 dB       | ±0.012 dB                  |
| −40 dB                           | −0.15 dB      | _____       | 0.15 dB       | ±0.014 dB                  |
| −50 dB                           | −0.35 dB      | _____       | 0.35 dB       | ±0.015 dB                  |
| −60 dB                           | −0.8 dB       | _____       | 0.8 dB        | ±0.024 dB                  |
| −70 dB                           | −1.8 dB       | _____       | 1.8 dB        | ±0.037 dB                  |

## Input B

| dB from<br>Reference Input Level | Minimum Limit | Test Result | Maximum Limit | Measurement<br>Uncertainty |
|----------------------------------|---------------|-------------|---------------|----------------------------|
| 10 dB                            | −0.05 dB      | _____       | 0.05 dB       | ±0.011 dB                  |
| −10 dB                           | −0.05 dB      | _____       | 0.05 dB       | ±0.011 dB                  |
| −20 dB                           | −0.05 dB      | _____       | 0.05 dB       | ±0.012 dB                  |
| −30 dB                           | −0.07 dB      | _____       | 0.07 dB       | ±0.012 dB                  |
| −40 dB                           | −0.15 dB      | _____       | 0.15 dB       | ±0.014 dB                  |
| −50 dB                           | −0.35 dB      | _____       | 0.35 dB       | ±0.015 dB                  |
| −60 dB                           | −0.8 dB       | _____       | 0.8 dB        | ±0.024 dB                  |
| −70 dB                           | −1.8 dB       | _____       | 1.8 dB        | ±0.037 dB                  |

---

## 15. INPUT ATTENUATOR SWITCHING UNCERTAINTY TEST

### Input R

| Input Attenuation | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|-------------------|---------------|-------------|---------------|-------------------------|
| 0 dB              | -1 dB         | _____       | 1 dB          | $\pm 0.017$ dB          |
| 20 dB             | -1 dB         | _____       | 1 dB          | $\pm 0.016$ dB          |
| 30 dB             | -1 dB         | _____       | 1 dB          | $\pm 0.016$ dB          |
| 40 dB             | -1.5 dB       | _____       | 1.5 dB        | $\pm 0.016$ dB          |
| 50 dB             | -1.5 dB       | _____       | 1.5 dB        | $\pm 0.024$ dB          |

### Input A

| Input Attenuation | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|-------------------|---------------|-------------|---------------|-------------------------|
| 0 dB              | -1 dB         | _____       | 1 dB          | $\pm 0.017$ dB          |
| 20 dB             | -1 dB         | _____       | 1 dB          | $\pm 0.016$ dB          |
| 30 dB             | -1 dB         | _____       | 1 dB          | $\pm 0.016$ dB          |
| 40 dB             | -1.5 dB       | _____       | 1.5 dB        | $\pm 0.016$ dB          |
| 50 dB             | -1.5 dB       | _____       | 1.5 dB        | $\pm 0.024$ dB          |

### Input B

| Input Attenuation | Minimum Limit | Test Result | Maximum Limit | Measurement Uncertainty |
|-------------------|---------------|-------------|---------------|-------------------------|
| 0 dB              | -1 dB         | _____       | 1 dB          | $\pm 0.017$ dB          |
| 20 dB             | -1 dB         | _____       | 1 dB          | $\pm 0.016$ dB          |
| 30 dB             | -1 dB         | _____       | 1 dB          | $\pm 0.016$ dB          |
| 40 dB             | -1.5 dB       | _____       | 1.5 dB        | $\pm 0.016$ dB          |
| 50 dB             | -1.5 dB       | _____       | 1.5 dB        | $\pm 0.024$ dB          |

## 16. NOISE SIDEBANDS TEST

### Input R

| Frequency | Offset<br>from Carrier | Test Result | Test Limit    | Measurement<br>Uncertainty |
|-----------|------------------------|-------------|---------------|----------------------------|
| 10 MHz    | -1 kHz                 | _____       | < -97 dBc/Hz  | ±2.14 dB                   |
|           | +1 kHz                 | _____       | < -97 dBc/Hz  | ±2.14 dB                   |
|           | -10 kHz                | _____       | < -97 dBc/Hz  | ±0.98 dB                   |
|           | +10 kHz                | _____       | < -97 dBc/Hz  | ±0.98 dB                   |
|           | -100 kHz               | _____       | < -110 dBc/Hz | ±2.14 dB                   |
|           | +100 kHz               | _____       | < -110 dBc/Hz | ±2.14 dB                   |
|           | -1 MHz                 | _____       | < -110 dBc/Hz | ±0.98 dB                   |
|           | +1 MHz                 | _____       | < -110 dBc/Hz | ±0.98 dB                   |
| 100 MHz   | -1 kHz                 | _____       | < -97 dBc/Hz  | ±2.14 dB                   |
|           | +1 kHz                 | _____       | < -97 dBc/Hz  | ±2.14 dB                   |
|           | -10 kHz                | _____       | < -97 dBc/Hz  | ±0.98 dB                   |
|           | +10 kHz                | _____       | < -97 dBc/Hz  | ±0.98 dB                   |
|           | -100 kHz               | _____       | < -110 dBc/Hz | ±2.14 dB                   |
|           | +100 kHz               | _____       | < -110 dBc/Hz | ±2.14 dB                   |
|           | -1 MHz                 | _____       | < -110 dBc/Hz | ±0.98 dB                   |
|           | +1 MHz                 | _____       | < -110 dBc/Hz | ±0.98 dB                   |
| 500 MHz   | -1 kHz                 | _____       | < -97 dBc/Hz  | ±2.14 dB                   |
|           | +1 kHz                 | _____       | < -97 dBc/Hz  | ±2.14 dB                   |
|           | -10 kHz                | _____       | < -97 dBc/Hz  | ±0.98 dB                   |
|           | +10 kHz                | _____       | < -97 dBc/Hz  | ±0.98 dB                   |
|           | -100 kHz               | _____       | < -110 dBc/Hz | ±2.14 dB                   |
|           | +100 kHz               | _____       | < -110 dBc/Hz | ±2.14 dB                   |
|           | -1 MHz                 | _____       | < -110 dBc/Hz | ±0.98 dB                   |
|           | +1 MHz                 | _____       | < -110 dBc/Hz | ±0.98 dB                   |

---

## 17. AMPLITUDE ACCURACY/FREQUENCY RESPONSE TEST

**Input R**

**Level Accuracy**

| Minimum Limit | Test Result | Maximum Limit | Measurement<br>Uncertainty |
|---------------|-------------|---------------|----------------------------|
| -0.8 dB       | _____       | 0.8 dB        | ±0.112 dB                  |

**Frequency Response**

| Frequency | Minimum Limit | Test Result | Test Limit | Measurement<br>Uncertainty |
|-----------|---------------|-------------|------------|----------------------------|
| 10 Hz     | -3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 15 Hz     | -3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 25 Hz     | -3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 40 Hz     | -3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 80 Hz     | -3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 100 Hz    | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 200 Hz    | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 500 Hz    | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 1 kHz     | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 2 kHz     | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 5 kHz     | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 10 kHz    | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 20 kHz    | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 50 kHz    | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 100 kHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 200 kHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 500 kHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 1 MHz     | -1.3 dB       | _____       | 1.3 dB     | ±0.077 dB                  |
| 2 MHz     | -1.3 dB       | _____       | 1.3 dB     | ±0.077 dB                  |
| 5 MHz     | -1.3 dB       | _____       | 1.3 dB     | ±0.077 dB                  |
| 8 MHz     | -1.3 dB       | _____       | 1.3 dB     | ±0.081 dB                  |
| 10 MHz    | -1.3 dB       | _____       | 1.3 dB     | ±0.081 dB                  |
| 20 MHz    | -1.3 dB       | _____       | 1.3 dB     | ±0.081 dB                  |



| Frequency | Minimum Limit | Test Result | Test Limit | Measurement<br>Uncertainty |
|-----------|---------------|-------------|------------|----------------------------|
| 100 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.093$ dB             |
| 125 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.093$ dB             |
| 150 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.093$ dB             |
| 175 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 200 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 225 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 250 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 275 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 300 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 325 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 350 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 375 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 400 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 425 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 450 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 475 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |
| 500 MHz   | -1.3 dB       | _____       | 1.3 dB     | $\pm 0.110$ dB             |

## Input A

## Level Accuracy

| Minimum Limit | Test Result | Maximum Limit | Measurement<br>Uncertainty |
|---------------|-------------|---------------|----------------------------|
| -0.8 dB       | _____       | 0.8 dB        | $\pm 0.112$ dB             |

## Frequency Response

| Frequency | Minimum Limit | Test Result | Test Limit | Measurement<br>Uncertainty |
|-----------|---------------|-------------|------------|----------------------------|
| 10 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 15 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 25 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 40 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 80 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 100 Hz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 200 Hz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 500 Hz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 1 kHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 2 kHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 5 kHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 10 kHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 20 kHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 50 kHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 100 kHz   | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 200 kHz   | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 500 kHz   | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 1 MHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.077 dB                  |
| 2 MHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.077 dB                  |
| 5 MHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.077 dB                  |
| 8 MHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.081 dB                  |
| 10 MHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.081 dB                  |
| 20 MHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.081 dB                  |

| Frequency | Minimum Limit | Test Result | Test Limit | Measurement<br>Uncertainty |
|-----------|---------------|-------------|------------|----------------------------|
| 100 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.093 dB                  |
| 125 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.093 dB                  |
| 150 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.093 dB                  |
| 175 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 200 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 225 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 250 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 275 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 300 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 325 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 350 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 375 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 400 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 425 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 450 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 475 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 500 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |

## Input B

## Level Accuracy

| Minimum Limit | Test Result | Maximum Limit | Measurement<br>Uncertainty |
|---------------|-------------|---------------|----------------------------|
| -0.8 dB       | _____       | 0.8 dB        | ±0.112 dB                  |

## Frequency Response

| Frequency | Minimum Limit | Test Result | Test Limit | Measurement<br>Uncertainty |
|-----------|---------------|-------------|------------|----------------------------|
| 10 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 15 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 25 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 40 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 80 Hz     | −3.0 dB       | _____       | 3.0 dB     | ±0.264 dB                  |
| 100 Hz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 200 Hz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 500 Hz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 1 kHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 2 kHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 5 kHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 10 kHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 20 kHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 50 kHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 100 kHz   | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 200 kHz   | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 500 kHz   | −1.3 dB       | _____       | 1.3 dB     | ±0.264 dB                  |
| 1 MHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.077 dB                  |
| 2 MHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.077 dB                  |
| 5 MHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.077 dB                  |
| 8 MHz     | −1.3 dB       | _____       | 1.3 dB     | ±0.081 dB                  |
| 10 MHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.081 dB                  |
| 20 MHz    | −1.3 dB       | _____       | 1.3 dB     | ±0.081 dB                  |

| Frequency | Minimum Limit | Test Result | Test Limit | Measurement<br>Uncertainty |
|-----------|---------------|-------------|------------|----------------------------|
| 100 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.093 dB                  |
| 125 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.093 dB                  |
| 150 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.093 dB                  |
| 175 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 200 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 225 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 250 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 275 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 300 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 325 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 350 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 375 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 400 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 425 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 450 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 475 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |
| 500 MHz   | -1.3 dB       | _____       | 1.3 dB     | ±0.110 dB                  |

---

## 18. SECOND HARMONIC DISTORTION TEST

| Frequency | Test Result | Test Limit | Measurement<br>Uncertainty |
|-----------|-------------|------------|----------------------------|
| 50.1 MHz  | _____       | < -70 dBc  | ±2.65 dB                   |

---

## 19. THIRD ORDER INTERMODULATION DISTORTION TEST

| Frequency | Test Result | Test Limit | Measurement<br>Uncertainty |
|-----------|-------------|------------|----------------------------|
| 100.2 MHz | _____       | < -70 dBc  | ±4.3 dB                    |

---

## 20. OTHER SPURIOUS TEST

| Input Frequency | Spurious Frequency | Test Result | Test Limit | Measurement Uncertainty |
|-----------------|--------------------|-------------|------------|-------------------------|
| 276.8666667 MHz | 300 MHz            | _____       | < -70 dBc  | ±2.52 dB                |
| 16.3 MHz        | 1 MHz              | _____       | < -70 dBc  | ±2.52 dB                |
| 212.8 MHz       | 210 MHz            | _____       | < -70 dBc  | ±2.52 dB                |
| 205.9 MHz       | 210 MHz            | _____       | < -70 dBc  | ±2.52 dB                |
| 213.7333333 MHz | 210 MHz            | _____       | < -70 dBc  | ±2.52 dB                |
| 209.1333333 MHz | 210 MHz            | _____       | < -70 dBc  | ±2.52 dB                |
| 6.897 MHz       | 6.900 MHz          | _____       | < -70 dBc  | ±2.14 dB                |
| 6.897 MHz       | 6.903 MHz          | _____       | < -70 dBc  | ±2.14 dB                |
| 256.897 MHz     | 256.900 MHz        | _____       | < -70 dBc  | ±2.14 dB                |
| 256.897 MHz     | 256.903 MHz        | _____       | < -70 dBc  | ±2.14 dB                |
| 494.397 MHz     | 494.400 MHz        | _____       | < -70 dBc  | ±2.14 dB                |
| 494.397 MHz     | 494.403 MHz        | _____       | < -70 dBc  | ±2.14 dB                |

---

## 21. RESIDUAL RESPONSE TEST

| Frequency       | Test Result | Test Limit |
|-----------------|-------------|------------|
| 100.18333 MHz   | _____       | < -108 dBm |
| 166.85 MHz      | _____       | < -108 dBm |
| 233.5166667 MHz | _____       | < -108 dBm |
| 366.85 MHz      | _____       | < -108 dBm |
| 433.5166667 MHz | _____       | < -108 dBm |
| 161.75 MHz      | _____       | < -108 dBm |
| 361.75 MHz      | _____       | < -108 dBm |
| 377.05 MHz      | _____       | < -108 dBm |
| 177.05 MHz      | _____       | < -108 dBm |
| 438.6166667 MHz | _____       | < -108 dBm |
| 371.95 MHz      | _____       | < -108 dBm |
| 238.6166667 MHz | _____       | < -108 dBm |
| 171.95 MHz      | _____       | < -108 dBm |
| 105.2833333 MHz | _____       | < -108 dBm |

## Adjustments

---

### Introduction

This section describes the Adjustments required for the 4395A to operate within its specifications. These adjustments should be performed along with periodic maintenance to keep the 4395A in optimum operating condition. The recommended calibration period is 12 months. If proper performance cannot be achieved after the Adjustments, see the Troubleshooting chapter.

---

**Note**

To ensure proper results and correct instrument operation, Agilent Technologies suggests a 30 minute warm-up and stabilization period before performing any of the following Adjustments.

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### Safety Considerations

This manual contains NOTES, CAUTIONS, and WARNINGS which must be followed to ensure the safety of the operator and to keep the instrument in a safe and serviceable condition. The adjustments must be performed by qualified service personnel.

---

**Warning**

**Any interruption of the protective ground conductor (inside or outside the instrument) or disconnection of the protective ground terminal can make the instrument dangerous. Intentional interruption of the protective ground system for any reason is prohibited.**

---

Remember that the capacitors in the analyzer can remain charged for several minutes, even through you have turned the analyzer OFF and unplugged it.

---

**Warning**

**The adjustments described in this chapter are performed with power applied and the protective covers removed. Dangerous voltage levels exist at many points and can result in serious personal injury or death if you come into contact with them.**

---

---

## Required Controller

Performing adjustments requires the following controller:

### Windows NT PC (Personal Computer)

Microprocessor Minimum: 80486, 33 MHz or faster.

RAM Minimum: 24 MB.

Mass Storage A 3.5-inch (1.44 MB) floppy disk drive, and a hard disk drive with at least 30 MB of free disk space.

Display System Ultra VGA (1024-by-768).

GPIB Card 82340 or 82341

OS Microsoft® Windows NT (version 3.51 or later),  
and HP VEE for Windows (version 3.2)

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## Software Requirements

The adjustments require the 4395A Adjustment Program. Agilent part number for the 4395A Adjustment Program for HP VEE/Windows is 04395-18004.



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## Required Test Equipment

Required equipment for performing the adjustments is listed in Table 5-1. Use only calibrated test equipment when adjusting the 4395A.

**Table 5-1. Required Test Equipment for Adjustments**

| Equipment               | Critical Specifications                                                                                                                       | Model                        | Qty |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----|
| Multimeter              | No substitute                                                                                                                                 | 3458A                        | 1   |
| Frequency Counter       | Frequency Range: 500 MHz, Time Base Error: $\leq \pm 1.9 \times 10^{-7}$ /year                                                                | 5334B                        | 1   |
| Frequency Standard      | Frequency: 10 MHz, Time Base Error: $\leq \pm 1 \times 10^{-10}$ /year                                                                        | 5061B                        | 1   |
| Signal Generator        | Frequency Range : 1 MHz to 500 MHz, SSB<br>Phase Noise at 100 Hz offset: $< -112$ dBc/Hz,<br>SSB Phase Noise at 1 kHz offset: $< -121$ dBc/Hz | 8642B/8644B/8663A            | 1   |
| Power Meter             | No substitute                                                                                                                                 | 436A Opt. 022, 437B, or 438A | 1   |
| Power Sensor            | Frequency Range : 1 MHz to 500 MHz, Power: $-26$ dBm to 0 dBm                                                                                 | 8482A                        | 1   |
| Two-Way Power Splitter  | Frequency Range: 100 kHz to 500 MHz, Output Tracking: $\leq 0.15$ dB                                                                          | 11667A                       | 1   |
| Cables                  | Type-N cable, 50 $\Omega$                                                                                                                     | 11500B or part of 11851B     | 1   |
|                         | BNC cable, 61 cm, 50 $\Omega$                                                                                                                 | PN 8120-1839                 | 1   |
|                         | BNC cable, 122 cm, 50 $\Omega$                                                                                                                | PN 8120-1840                 | 1   |
| Adapters                | N(m)-N(m) adapter, 50 $\Omega$                                                                                                                | PN 1250-1475                 | 1   |
|                         | BNC(f)-Dual Banana Plug Adapter, 50 $\Omega$                                                                                                  | PN 1251-2277                 | 1   |
|                         | N(m)-BNC(f) adapter, 50 $\Omega$                                                                                                              | PN 1250-0780                 | 1   |
| 50 $\Omega$ Feedthrough | Rejection at 75 MHz: $\geq 60$ dB                                                                                                             | PN 04192-61002               | 1   |

---

## Order of Adjustments

When performing more than one Adjustments or Correction Constants procedure, perform them in the order they appear in this chapter. The procedures are presented in the following order:

**Table 5-2. Adjustment and Correction Constants Items**

| Adjustments and Correction Constants   | HP VEE |
|----------------------------------------|--------|
| Frequency Reference Adjustment         |        |
| Oven Reference Adjustment (Option 1D5) |        |
| Local DAC Adjustment                   | ✓      |
| Source Power Adjustment                | ✓      |
| Source Flatness Adjustment             | ✓      |
| Input DC Offset Adjustment             |        |
| Input Local Null Adjustment            |        |
| IF 24 dB Gain/Phase Adjustment         | ✓      |
| Receiver Gain Adjustment               |        |
| IF 8 dB/16 dB Gain Adjustment          | ✓      |
| Temperature Adjustment                 | ✓      |
| Receiver Flatness Adjustment           | ✓      |
| Receiver Attenuator Adjustment         | ✓      |
| IF BPF Flatness Adjustment             | ✓      |
| DC Bias Adjustment (Option 010)        | ✓      |

---

**Note**



The adjustments without the check in the Table 5-2 does not require the HP VEE Adjustment Program to perform the adjustment. You should perform them manually or use the internal adjustment tests.

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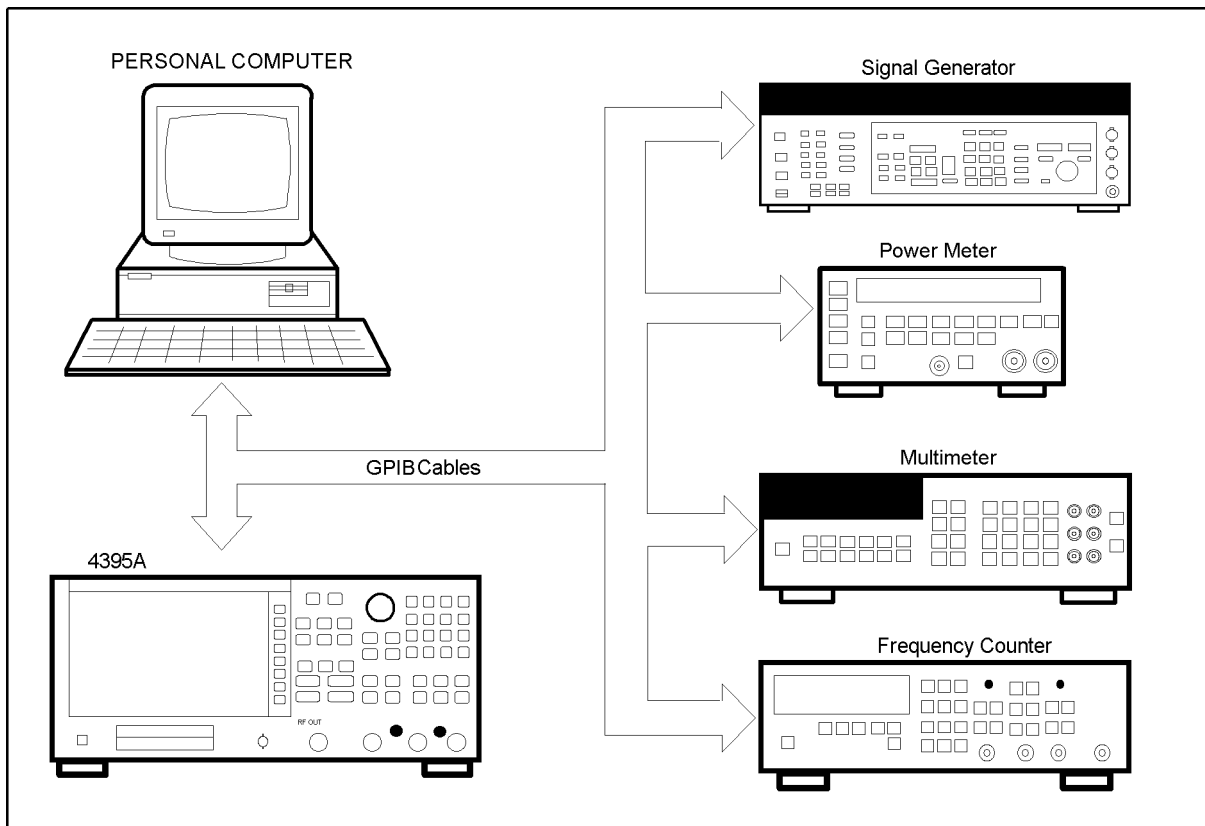
## Performing Adjustments

The adjustments are empirically derived data that is stored in memory and then recalled to refine the 4395A's measurement and to define its operation.

### Setting Up the System

Performing adjustments requires the system described in this section.

The Hardware Setup is shown in Figure 5-1.



CCS05001

**Figure 5-1. Adjustment Hardware Setup**

---

## Preparation for Using the Adjustment Program

To use the 4395A adjustment program, it is first necessary to install an GPIB Card. This section describes how to install it.

### Installing an GPIB Card (82340 or 82341)

Install an GPIB Card in your computer (see the GPIB Card manual). The select code of the GPIB Card should be set to “7”. The GPIB Card should be the 82340 or 84321. Other GPIB Cards can not be used in the Windows NT environment.

### Installing HP VEE for Windows NT

Install the HP VEE for Windows NT in your computer (see the HP VEE for Windows NT manual).

After installing HP VEE for Windows NT, run the *Configure I/O* utility in the *HP VEE for Windows NT* group by double-clicking on its icon to check that the GPIB Interface Board is correctly installed.

### Installing Adjustment Program into Your PC

Make a directory named 4395A on the C drive and copy the 4395A adjustment program under the created directory.

---

## Getting Started

1. Start the HP VEE by clicking the HP VEE icon on your PC.
2. Load the adjustment program file into the HP VEE as follows:
  - a. Pull down the **File** menu from the HP VEE window and select **File - Open**.
  - b. Select the file `C:\4395A\ADJUST.VEE`.
  - c. Press **OK**.

---

### Note



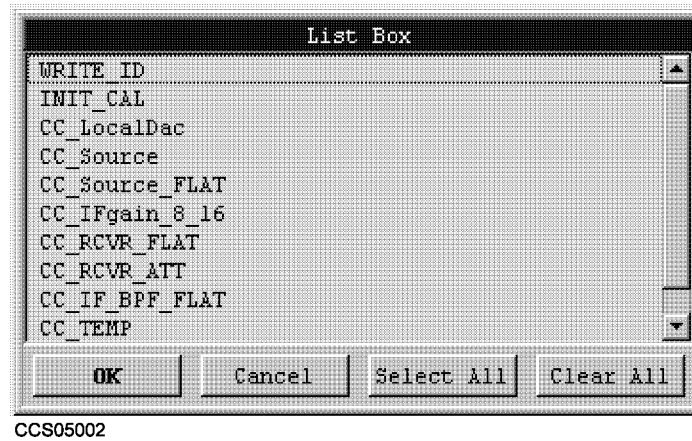
You may be asked GPIB addresses of the test equipment during the program loading. Enter the address for each equipment. Enter 0 as the address for the equipment which are not used for the adjustment test.

---

3. Press **Start** button on the Adjustment Program screen.
4. In the “Setup” window, modify the settings if required.
5. Press **OK**.
6. Modify the calibration factor of the 8482A in the window.
7. Press **OK**.
8. Select the model number and press **OK**.

9. Enter the serial number of the 4395A exactly. For example,  

JP1E00123
10. Mark installed options of the 4395A. The installed options can be confirmed on the rear pannel of the 4395A, or when you turn the 4395A ON, you can see the installed options before the 4395A starts measurement.
11. Press **NEXT STEP**.



**Figure 5-2. List Box**

---

**Note**



“WRITE\_ID” is used to write required identification data into the internal memory of the 4395A. “INIT\_CAL” is used to delete correction constants. See *Post Repair Procedure* for details.

---

---

## 1. Frequency Reference Adjustment

The purpose of this procedure is to adjust the 10 MHz reference clock in the 4395A.

---

### Note



HP VEE Adjustment Program is not required in this adjustment. Follow the procedures below and adjust proper item manually.

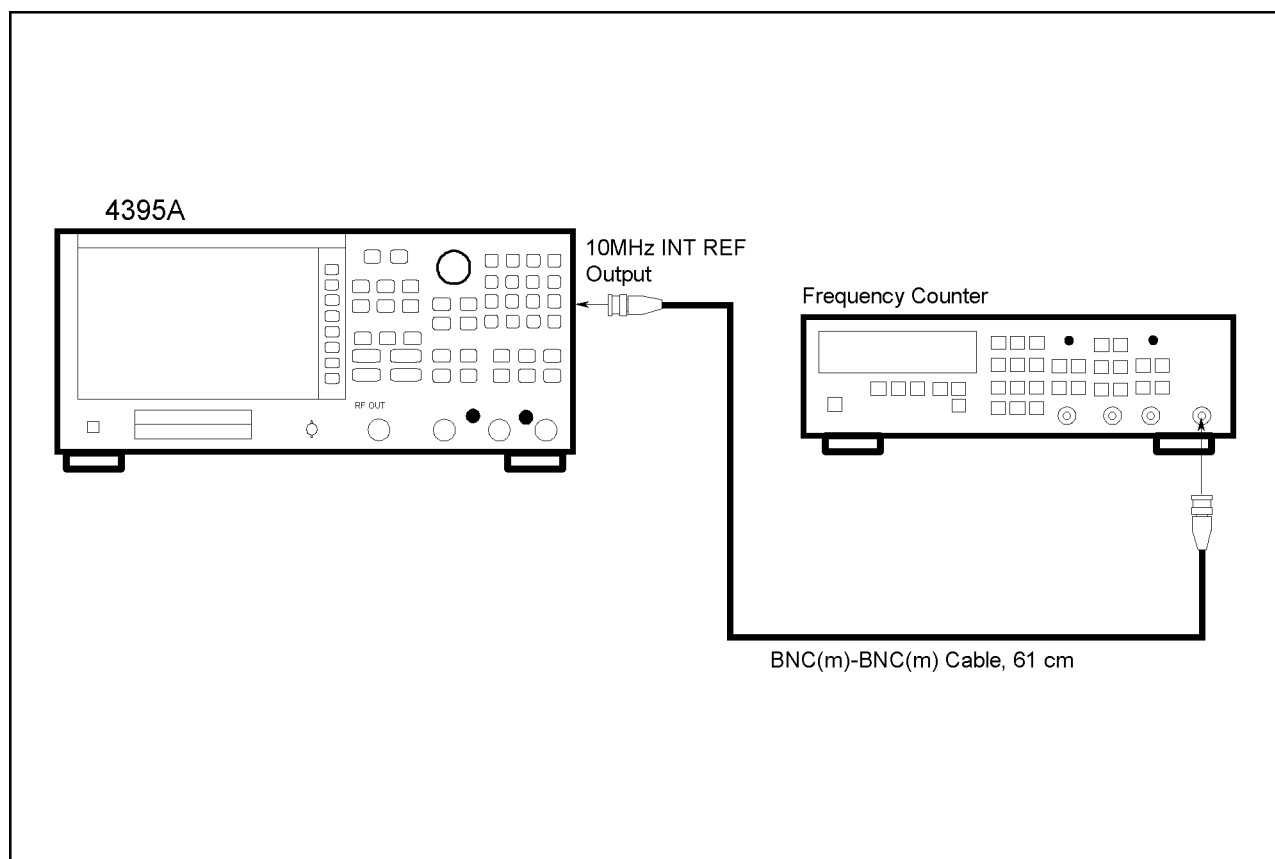
---

### Required Equipment

|                         |              |
|-------------------------|--------------|
| Frequency Counter ..... | 5334B        |
| BNC cable, 61 cm .....  | PN 8120-1839 |

### Procedure

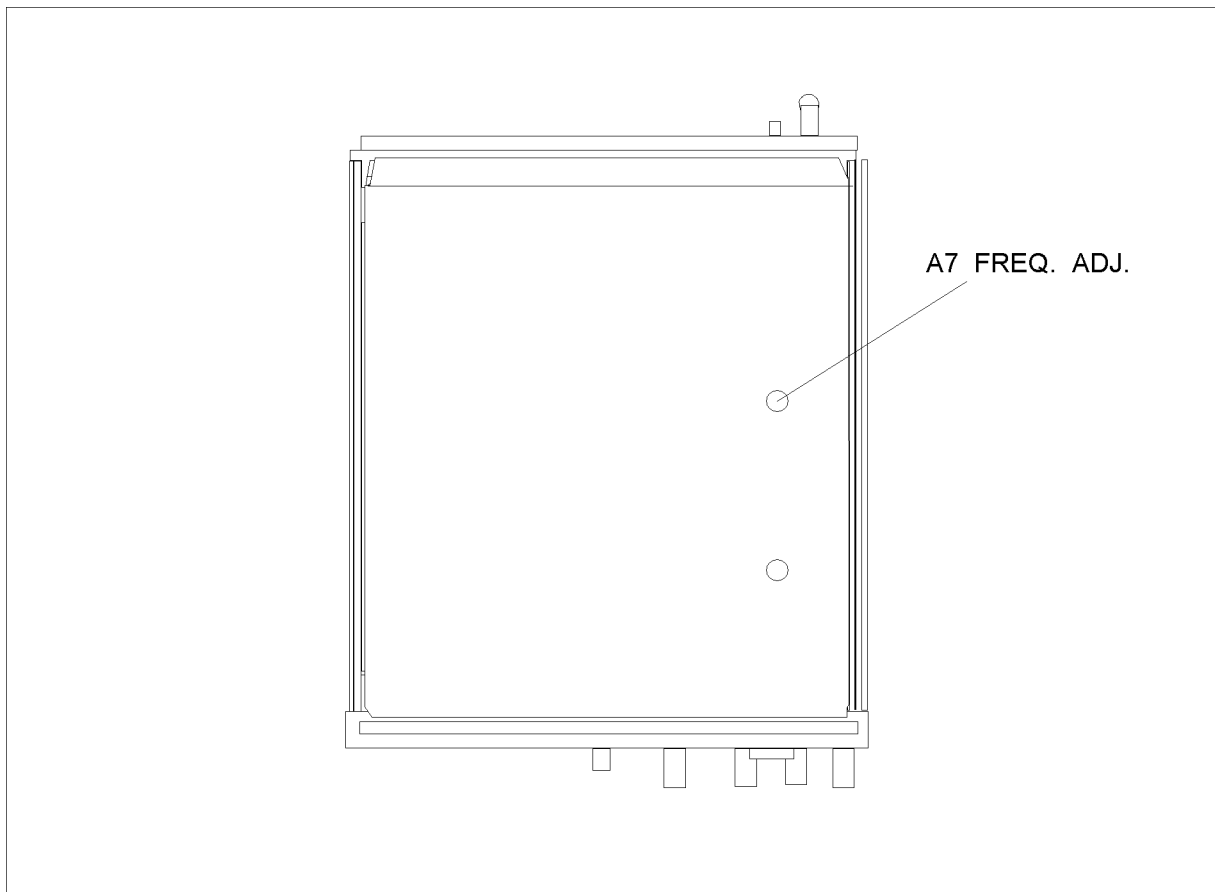
1. Turn the 4395A OFF.
2. To gain access to the adjustment components, remove the top cover of the 4395A.
3. Remove the BNC-BNC adapter from 10 MHz INT REF Output and REF OVEN connectors.
4. Connect the test equipment as shown in Figure 5-3 to monitor the 10 MHz reference clock.



CCS05003

**Figure 5-3. Frequency Reference Adjustment Setup**

5. Turn the 4395A ON.
6. Adjust “A7 Freq. Adj” until the frequency counter reads  $10\text{ MHz} \pm 5\text{ Hz}$ .



CCS05014

**Figure 5-4. Frequency Reference Adjustment Location**

7. Turn the 4395A OFF.
8. Reconnect the BNC-BNC adapter and install the top cover.

---

## 2. Oven Reference Adjustment (Option 1D5)

The purpose of this procedure is to adjust the 10 MHz oven reference clock.

### Required Equipment

|                           |                    |
|---------------------------|--------------------|
| Frequency Counter .....   | 5334B              |
| Frequency Standard .....  | 5061B <sup>1</sup> |
| BNC cable, 61 cm .....    | PN 8120-1839       |
| BNC cable, 122 cm .....   | PN 8120-1840       |
| N(m)-BNC(f) adapter ..... | PN 1250-0780       |

### Procedure

---



**Note** HP VEE Adjustment Program is not required in this adjustment. Follow the procedures below and adjust proper item manually.

---

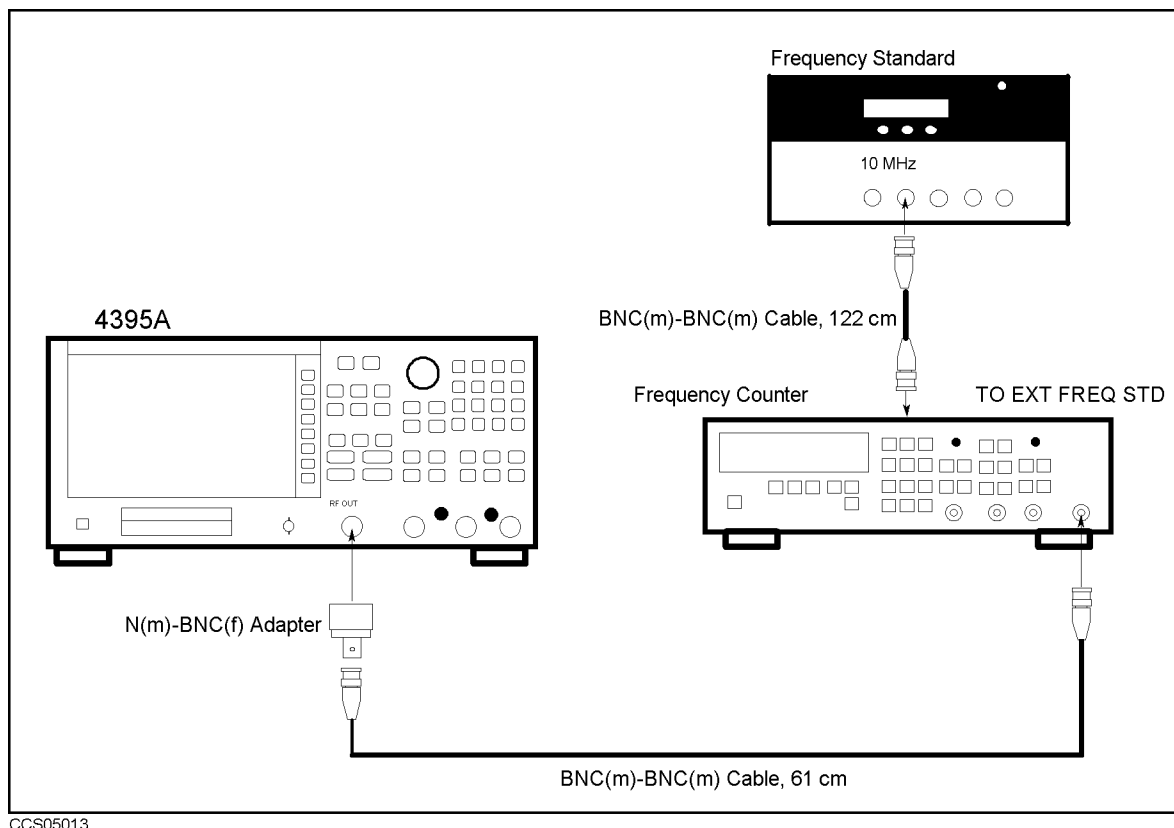
### Required Equipment

|                         |              |
|-------------------------|--------------|
| Frequency Counter ..... | 5334B        |
| BNC cable, 61 cm .....  | PN 8120-1839 |

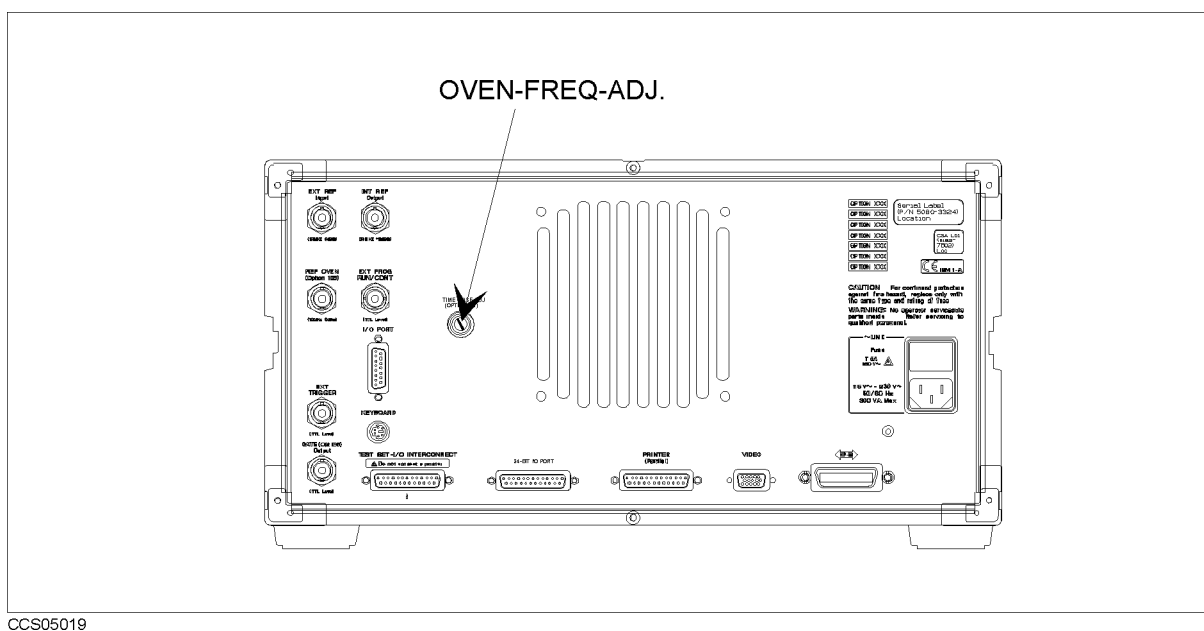
### Procedure

1. Turn the 4395A OFF.
2. To gain access to the adjustment components, remove the top cover of the 4395A.
3. Remove the BNC-BNC adapter from 10 MHz INT REF Output and REF OVEN connectors.
4. Connect the test equipments as shown in Figure 5-5 to monitor the 10 MHz reference clock.





5. Remove the screw on the TIME BASE ADJ on the rear panel.



6. Turn the 4395A ON.
7. Adjust "OVEN-FREQ-ADJ" on the rear panel until the frequency counter reads  $10\text{ MHz} \pm 0.1\text{ Hz}$ .
8. Turn the 4395A OFF.
9. Install the screw on the TIME BASE ADJ. on the rear panel.
10. Reconnect the BNC-BNC adapter and install the top cover.

---

### 3. Local DAC Adjustment

The purpose of this procedure is to adjust the Local Pretune DAC.

#### Required Equipment

None

#### Procedure

1. Run the Adjustment Program
2. Select the “CC\_LocalDac” and press  in the list box.
3. Following the Adjustment Program instructions, complete this procedure.

---

## 4. Source Power Adjustment

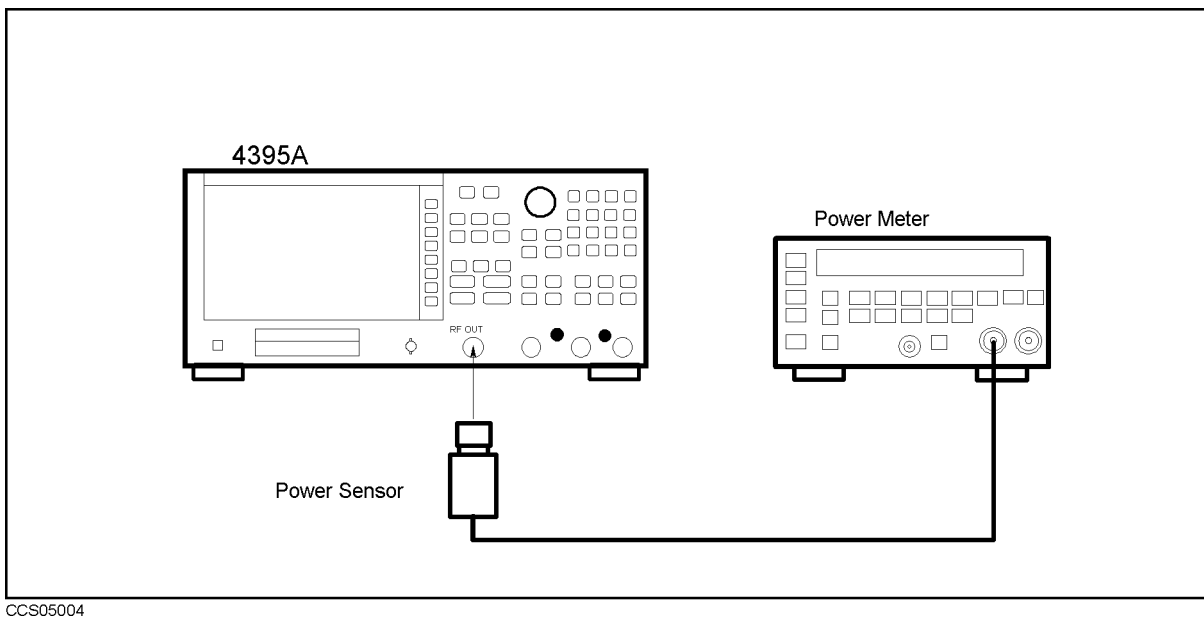
The purpose of this procedure is to adjust level vernier of the Network Analysis source.

### Required Equipment

Power Meter ..... 436A Opt. 022, 437B, or 438A  
Power Sensor ..... 8482A

### Procedure

1. Run the Adjustment Program
2. Select the “CC\_Source” and press **OK** in the list box.
3. Following the Adjustment Program instructions, complete this procedure.



**Figure 5-7. Source Power Adjustment Setup**

---

## 5. Source Flatness Adjustment

The purpose of this procedure is to adjust the source flatness.

### Required Equipment

None

### Procedure

1. Run the Adjustment Program
2. Select the “CC\_Source\_FLAT” and press  in the list box.
3. Following the Adjustment Program instructions, complete this procedure.

---

## 6. Input DC Offset Adjustment

The purpose of this procedure is to adjust the DC Bias offset value.

### Note



HP VEE Adjustment Program is not required in this adjustment. Follow the procedures below and adjust proper item using the internal adjustment test.

---

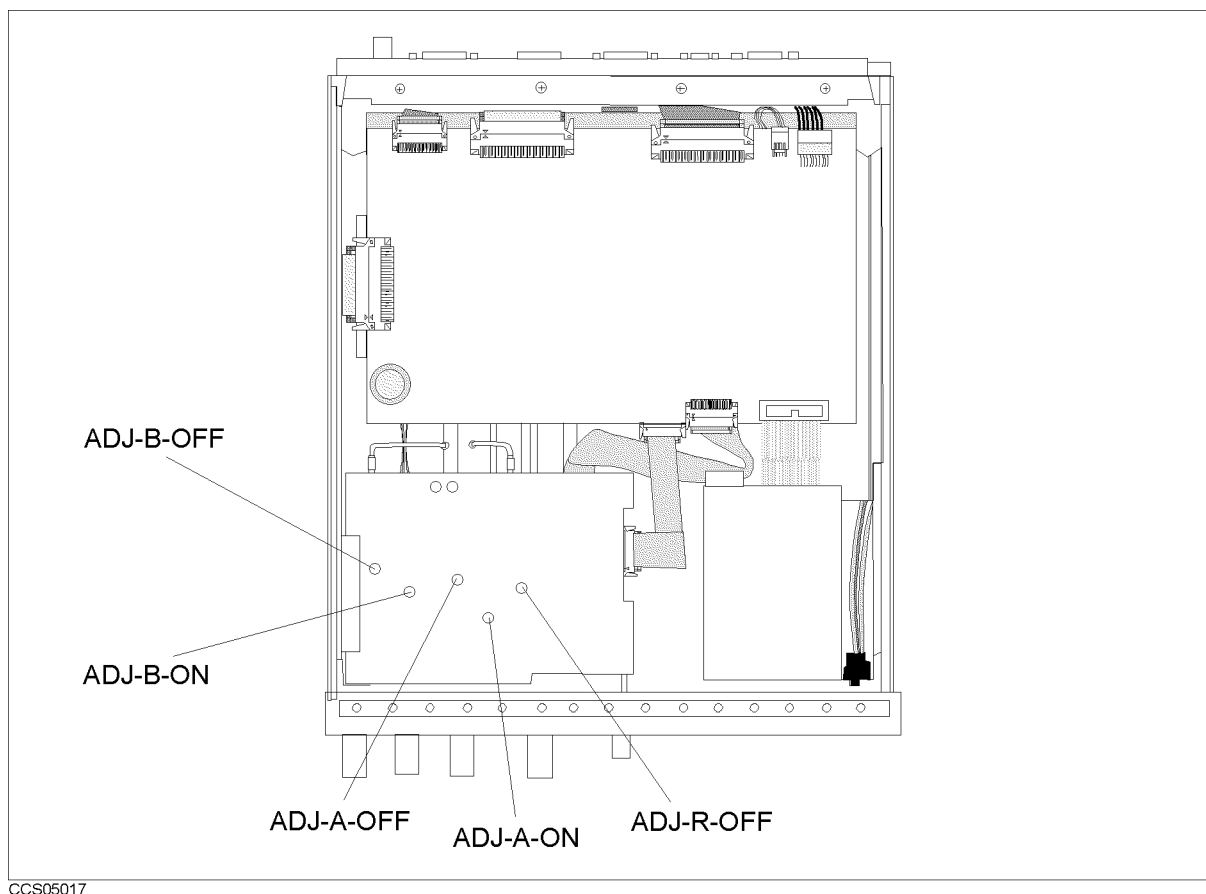
### Required Equipment

None

### Procedure

1. Turn the 4395A OFF.
2. To gain access to the adjustment components, remove the bottom cover of the 4395A.
3. Turn the 4395A ON.
4. Press **System**, **MORE**, **SERVICE TESTS**, **ADJUSTMENT TESTS** to display the internal adjustment tests menu.
5. Press **6**, **0** or use **↑**/**↓** to select the the internal adjustment test 60: A9 A ON ADJ.
6. Press **EXECUTE TEST** to run the test.
7. Adjust “ADJ-A-ON” on the A9 Input Multiplexer Board until pass is displayed on the screen.
8. Press **CONT** to exit the adjustment.
9. Press **6**, **1** or use **↑** to select the internal adjustment test 61: A9 B ON ADJ.
10. Press **EXECUTE TEST** to run the test.
11. Adjust “ADJ-B-ON” on the A9 Input Multiplexer Board until pass is displayed on the screen.
12. Press **CONT** to exit the adjustment.
13. Press **6**, **2** or use **↑** to select the internal adjustment test 62: A9 R OFF ADJ.
14. Press **EXECUTE TEST** to run the test.
15. Adjust “ADJ-R-OFF” on the A9 Input Multiplexer Board until pass is displayed on the screen.
16. Press **CONT** to exit the adjustment.
17. Press **6**, **3** or use **↑** to select the internal adjustment test 63: A9 A OFF ADJ.
18. Press **EXECUTE TEST** to run the test.
19. Adjust “ADJ-A-OFF” on the A9 Input Multiplexer Board until pass is displayed on the screen.
20. Press **CONT** to exit the adjustment.

21. Press **6**, **4** or use **↑** to select the internal adjustment test 64: A9 B OFF ADJ.
22. Press **EXECUTE TEST** to run the test.
23. Adjust “ADJ-B-OFF” on the A9 Input Multiplexer Board until pass is displayed on the screen.
24. Press **CONT** to exit the adjustment.
25. Turn the 4395A OFF and install the bottom cover.



**Figure 5-8. Input DC Offset Adjustment Location**

---

## 7. Input Local Null Adjustment

The purpose of this procedure is to minimize the first local leakage.

---

### Note



HP VEE Adjustment Program is not required in this adjustment. Follow the procedures below and adjust proper item using the internal adjustment test.

---

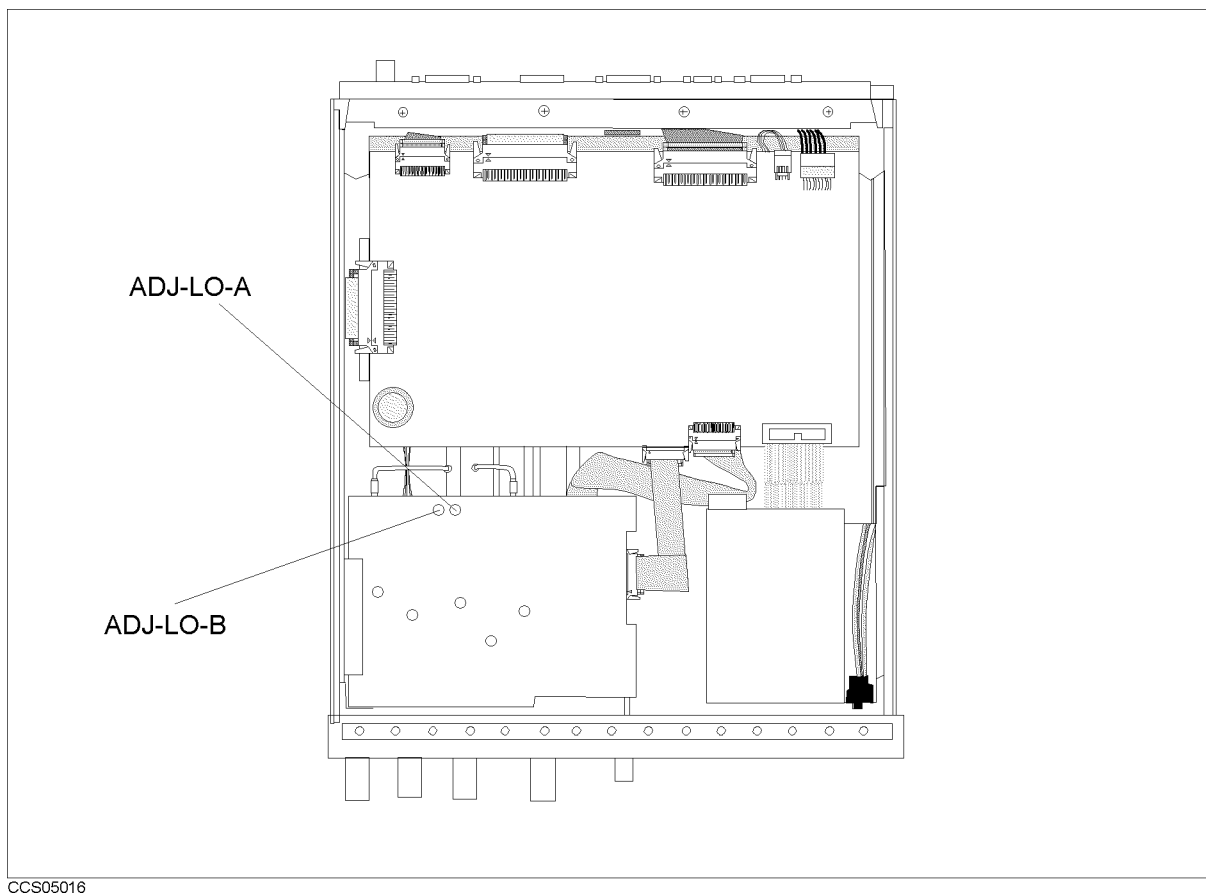
### Required Equipment

None

### Procedure

1. Turn the 4395A OFF.
2. To gain access to the adjustment components, remove the top and bottom covers of the 4395A.
3. Turn the 4395A ON.
4. Press **(System)**, **SERVICE TESTS**, **ADJUSTMENT TESTS** to display the internal adjustment tests menu.
5. Press **(6)**, **(5)** or use **(↑)**/**(↓)** to select the internal adjustment test 65: A9 LO ADJ.
6. Press **EXECUTE TEST** to run the test.
7. Adjust “ADJ-LO-A” and “ADJ-LO-B” on the A9 Input Multiplexer Board until pass is displayed on the screen.





**Figure 5-9. Input Local Null Adjustment Location**

8. Press **CONT** to exit the adjustment.
9. Turn the 4395A OFF and install the bottom cover.

---

## 8. IF 24 dB Gain/Phase Adjustment

The purpose of this procedure is to adjust the gain/phase of third IF.

---

### Note



HP VEE Adjustment Program is not required in this adjustment. Follow the procedures below and adjust proper item using the internal adjustment test.

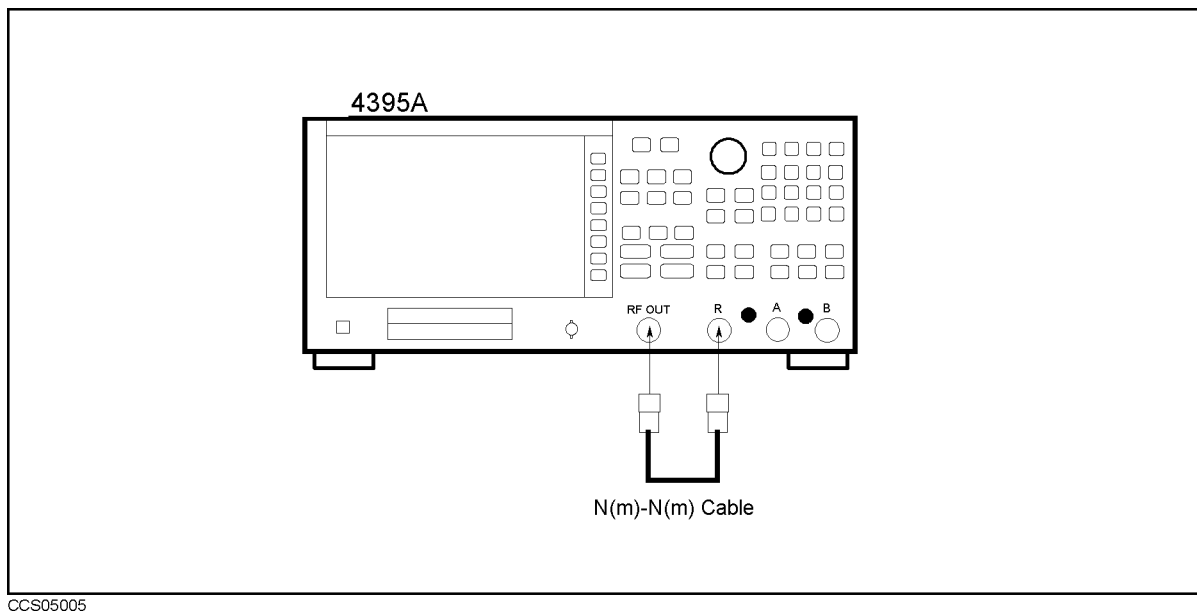
---

### Required Equipment

Type-N Cable, 61 cm .....11500B or part of 11851B

### Procedure

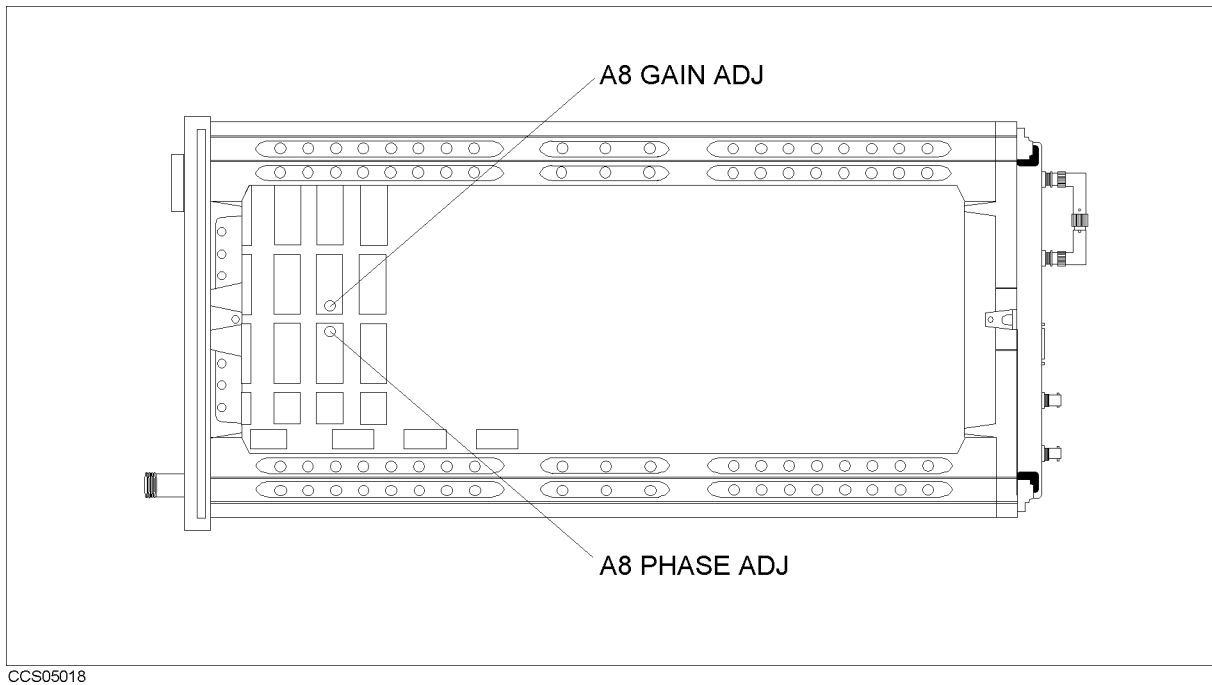
1. Turn the 4395A OFF.
2. To gain access to the adjustment components, remove the right side cover of the 4395A.
3. Turn the 4395A ON.
4. Press **System**, **MORE**, **SERVICE TESTS**, **ADJUSTMENT TESTS** to display the internal adjustment tests menu.
5. Press **6**, **6** or use **↑**/**↓** to select the internal adjustment test 66: A8 GAIN/PHASE ADJ.
6. Press **EXECUTE TEST** to run the test.
7. Connect the test equipment as shown in the Figure 5-10.



**Figure 5-10. IF 24 dB Gain/Phase Adjustment Setup**

8. Press **CONT** to continue the adjustment.

9. Adjust “A8 GAIN ADJ” and “A8 PHASE ADJ” on the A8 Digital IF Board until pass is displayed on the screen.



**Figure 5-11. IF 24 dB Gain/Phase Adjustment Location**

10. Press **CONT** to exit the adjustment.
11. Turn the 4395A OFF and install the side cover.

---

## 9. Receiver Gain Adjustment

The purpose of this procedure is to adjust the total gain of the receiver.

---

### Note



HP VEE Adjustment Program is not required in this adjustment. Follow the procedures below and adjust proper item using the internal adjustment test.

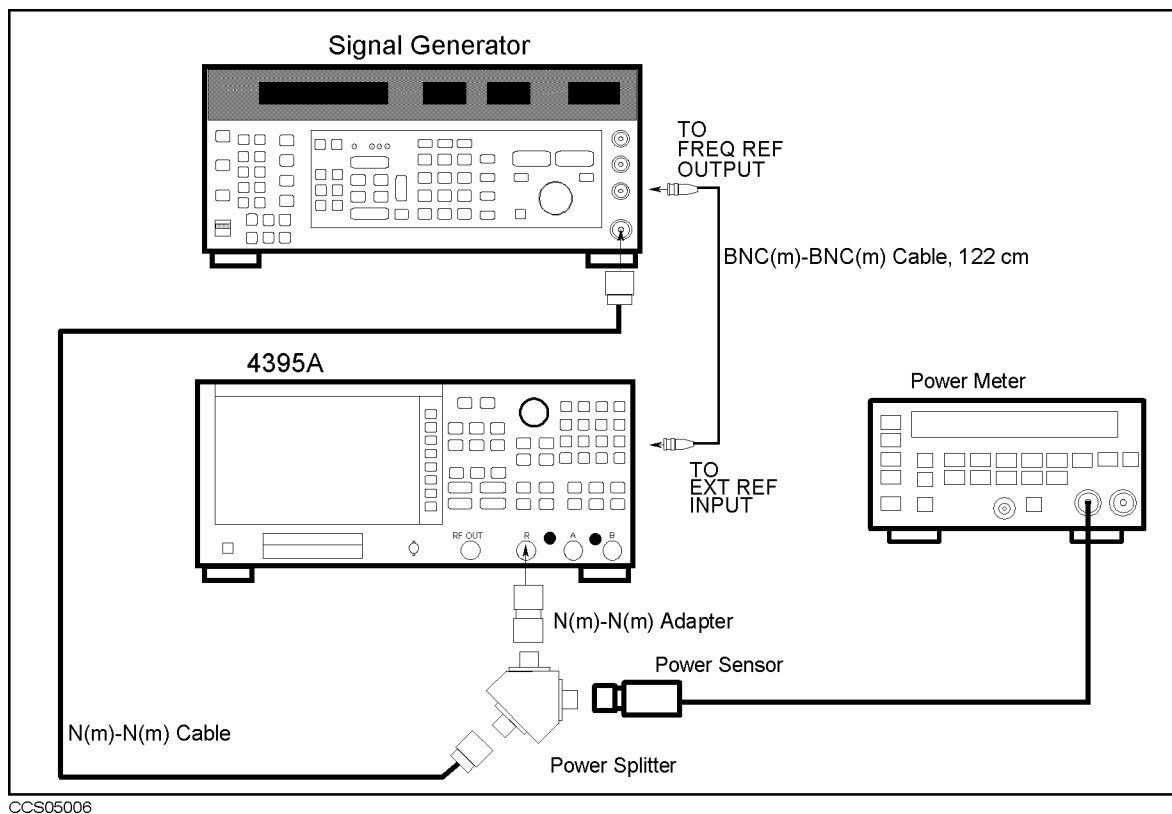
---

### Required Equipment

|                              |                              |
|------------------------------|------------------------------|
| Signal Generator .....       | 8642B/8644B/8663A            |
| Power Meter .....            | 436A Opt. 022, 437B, or 438A |
| Power Sensor .....           | 8482A                        |
| Two-Way Power Splitter ..... | 11667A                       |
| Type-N Cable, 61 cm .....    | 11500B or part of 11851B     |
| N(m)-N(m) adapter .....      | PN 1250-1475                 |

### Procedure

1. Turn the 4395A OFF.
2. To gain access to the adjustment components, remove the top cover of the 4395A.
3. Turn the 4395A ON.
4. Press **System**, **SERVICE TESTS**, **ADJUSTMENT TESTS** to display the internal adjustment tests menu.
5. Press **6**, **7** or use **↑**/**↓** to select the internal adjustment test 67: A7 GAIN ADJ.
6. Press **EXECUTE TEST** to run the test.
7. Connect the test equipment as shown in the Figure 5-12.



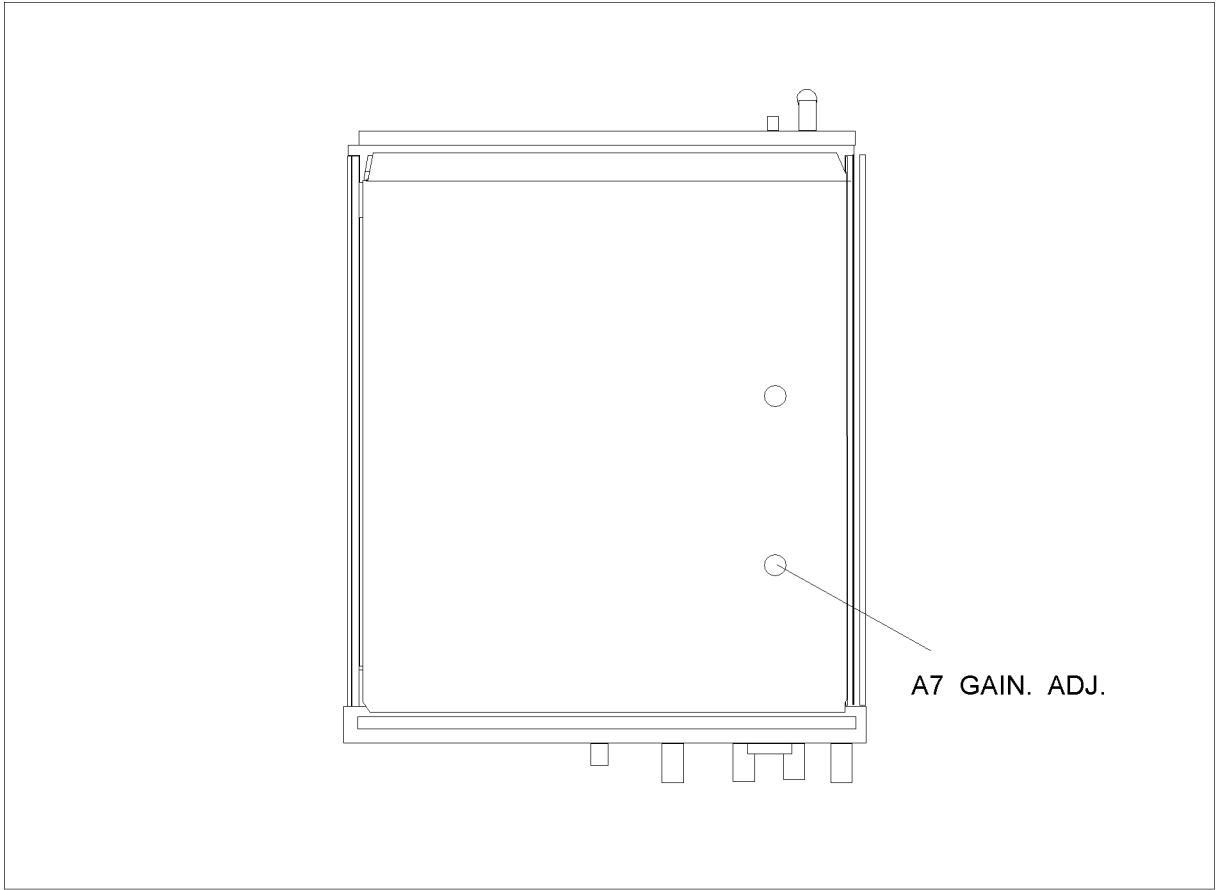
**Figure 5-12. Receiver Gain Adjustment Setup**

8. Initialize the signal generator. Then set the control as follows:

| Controls  | Settings |
|-----------|----------|
| Frequency | 16 MHz   |
| Amplitude | 6 dBm    |

9. On the signal generator, adjust the amplitude until the power meter' reads  $0 \pm 0.05$  dBm.

10. Adjust "A7 GAIN ADJ" until pass is displayed on the screen.



CCS05015

**Figure 5-13. Receiver Gain Adjustment Location**

## 10. IF 8 dB/16 dB Gain Adjustment

The purpose of this procedure is to generate the correction constants for the 8 dB/16 dB amplifier on the A/D converter assy.

### Required Equipment

|                        |       |                              |
|------------------------|-------|------------------------------|
| Power Meter            | ..... | 436A Opt. 022, 437B, or 438A |
| Power Sensor           | ..... | 8482A                        |
| Signal Generator       | ..... | 8642B/8644B/8663A            |
| Multimeter             | ..... | 3458A                        |
| Two-Way Power Splitter | ..... | 11667A                       |
| Type-N Cable, 61 cm    | ..... | 11500B or part of 11851B     |
| N(m)-N(m) adapter      | ..... | PN 1250-1475                 |
| BNC cable, 122 cm      | ..... | PN 8120-1840                 |

### Procedure

1. Run the Adjustment Program
2. Select the “CC\_IFgain\_8\_16” and press **OK** in the list box.
3. Following the Adjustment Program instructions, complete this procedure.

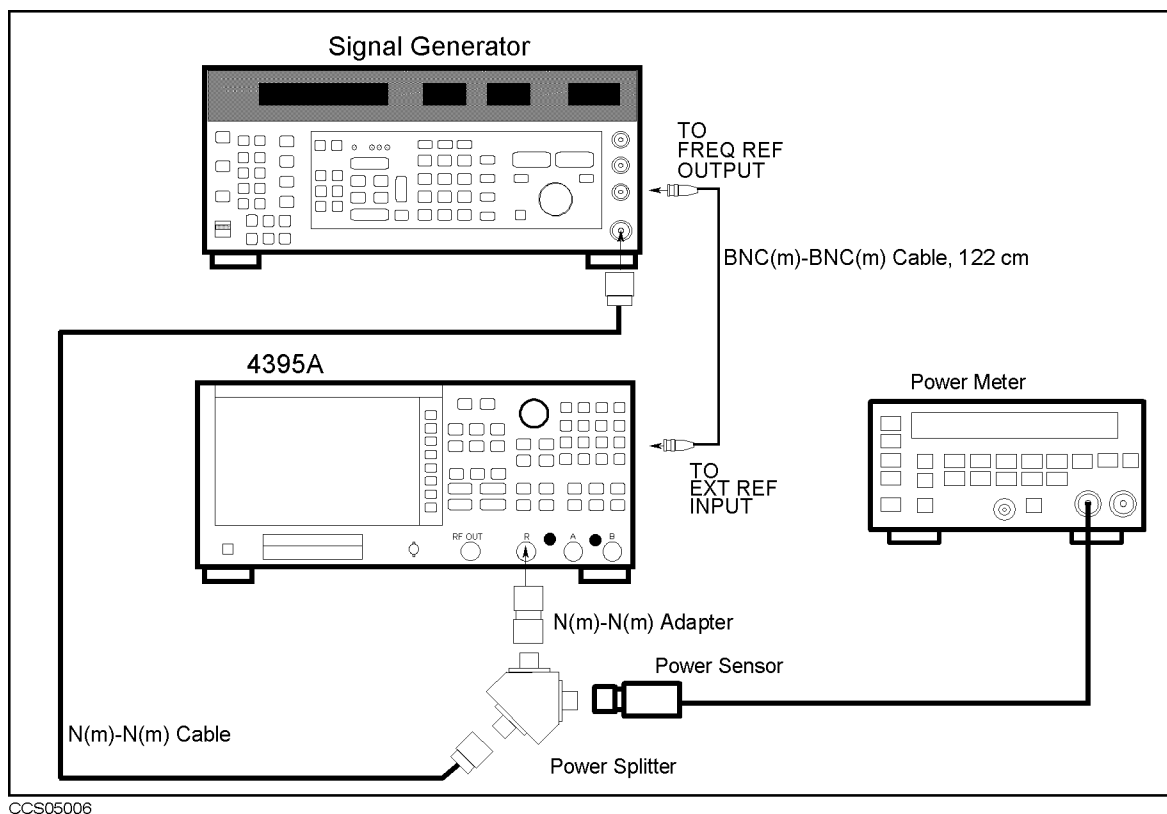


Figure 5-14. IF 8 dB/16 dB Gain Adjustment Setup

---

## 11. Temperature Adjustment

The purpose of this procedure is to record the temperature during adjustments.

### Required Equipment

None

### Procedure

1. Run the Adjustment Program
2. Select the “CC\_TEMP” and press **OK** in the list box.
3. Following the Adjustment Program instructions, complete this procedure.



## 12. Receiver Flatness Adjustment

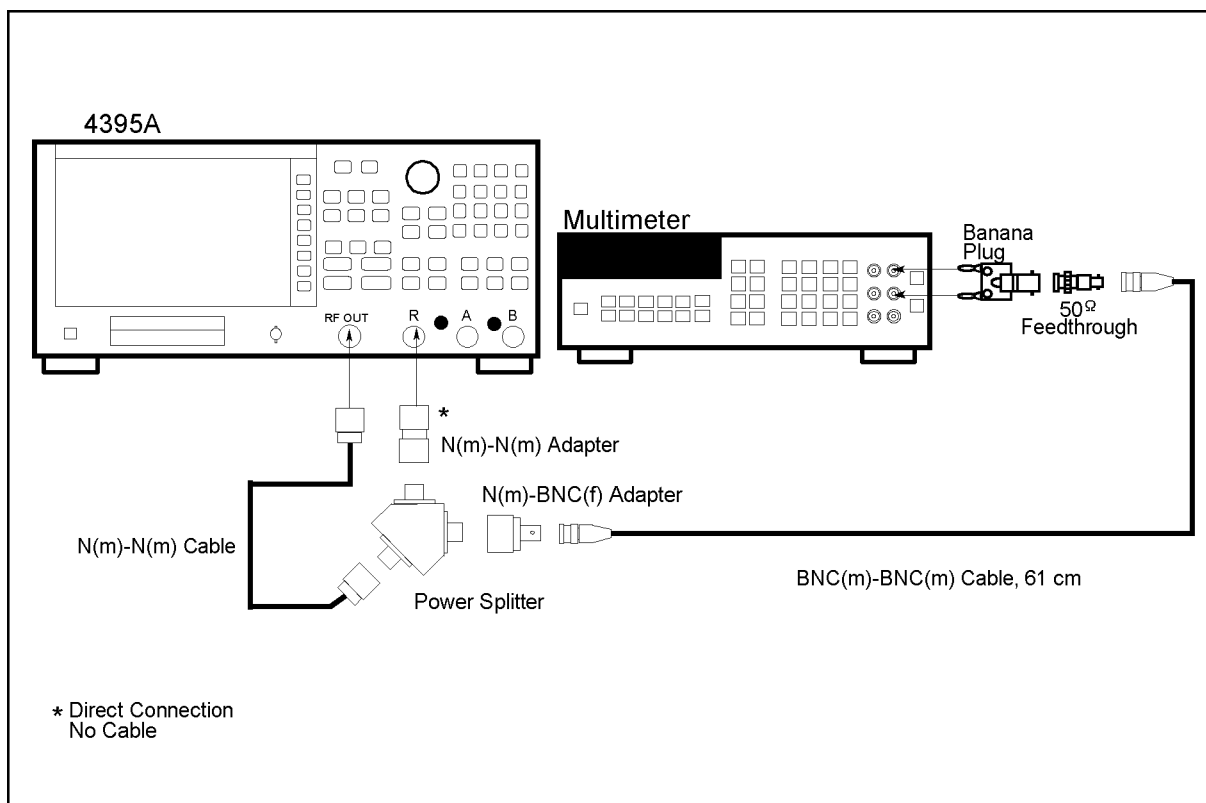
The purpose of this procedure is to obtain the correction constants that correct the receiver flatness.

### Required Equipment

|                                       |                              |
|---------------------------------------|------------------------------|
| Power Meter .....                     | 436A Opt. 022, 437B, or 438A |
| Power Sensor .....                    | 8482A                        |
| Multimeter .....                      | 3458A                        |
| Two-Way Power Splitter .....          | 11667A                       |
| Type-N Cable, 61 cm .....             | 11500B or part of 11851B     |
| N(m)-N(m) adapter .....               | PN 1250-1475                 |
| N(m)-BNC(f) adapter .....             | PN 1250-0780                 |
| BNC cable, 61 cm .....                | PN 8120-1839                 |
| 50 $\Omega$ Feedthrough .....         | PN 04192-61002               |
| BNC(f)-Dual Banana Plug Adapter ..... | PN 1251-2277                 |

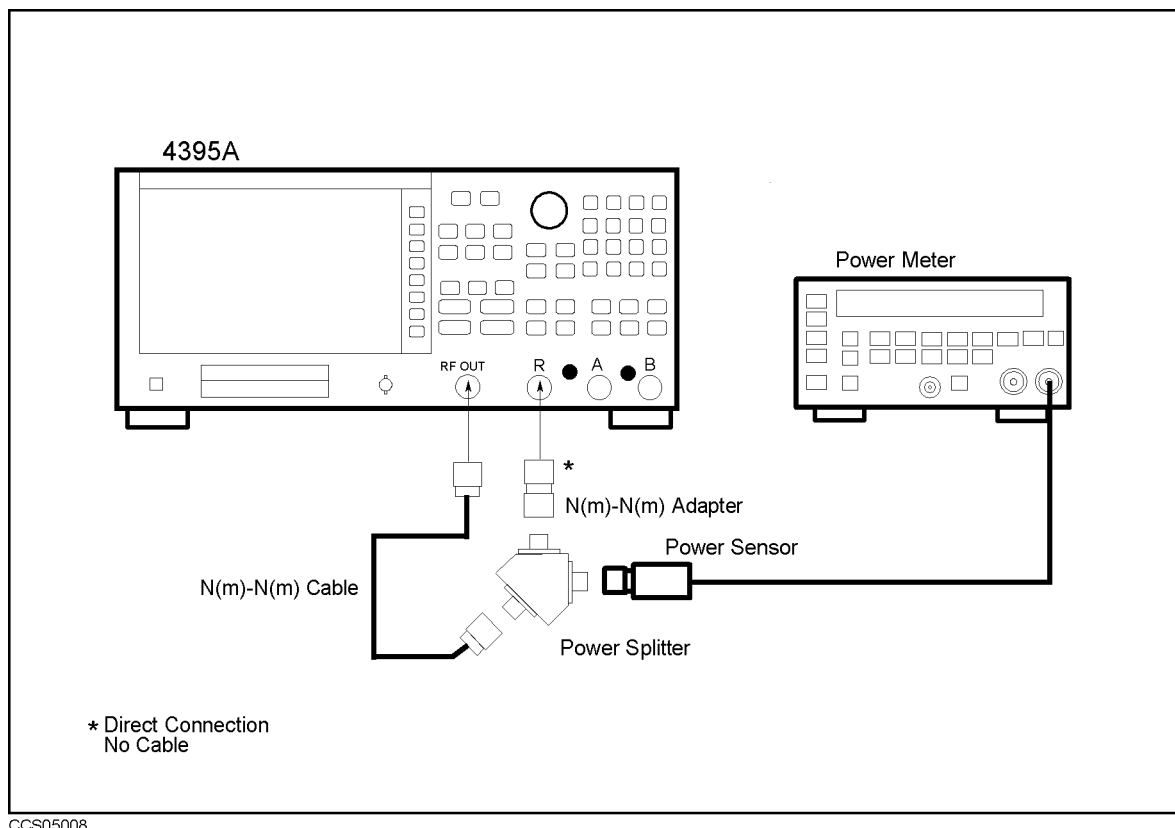
### Procedure

1. Run the Adjustment Program
2. Select the "CC\_RCVR\_FLAT" and press **OK** in the list box.
3. Following the Adjustment Program instructions, complete this procedure.



CCS05007

Figure 5-15. Receiver Flatness Adjustment Setup (< 1 MHz)



**Figure 5-16. Receiver Flatness Adjustment Setup ( $\geq 1$  MHz)**

---

## 13. Receiver Attenuator Adjustment

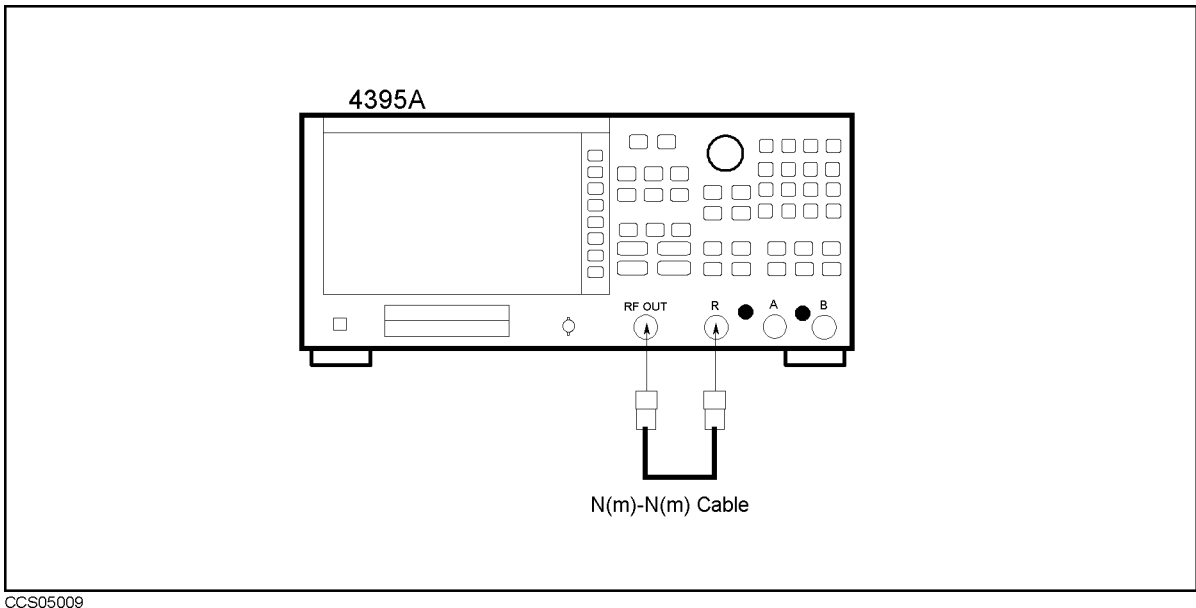
The purpose of this procedure is to obtain the correction constants to correct the receiver.

### Required Equipment

Type-N Cable, 61 cm .....11500B or part of 11851B

### Procedure

1. Run the Adjustment Program
2. Select the “CC\_RCVR\_ATT” and press **OK** in the list box.
3. Following the Adjustment Program instructions, complete this procedure.



**Figure 5-17. Receiver Attenuator Adjustment Setup**

## 14. IF BPF Flatness Adjustment

The purpose of this procedure is to adjust the IF Band Pass Filter.

### Required Equipment

|                              |                              |
|------------------------------|------------------------------|
| Power Meter .....            | 436A Opt. 022, 437B, or 438A |
| Power Sensor .....           | 8482A                        |
| Signal Generator .....       | 8642B/8644B/8663A            |
| Multimeter .....             | 3458A                        |
| Two-Way Power Splitter ..... | 11667A                       |
| Type-N Cable, 61 cm .....    | 11500B or part of 11851B     |
| N(m)-N(m) adapter .....      | PN 1250-1475                 |
| BNC cable, 122 cm .....      | PN 8120-1840                 |

### Procedure

1. Run the Adjustment Program
2. Select the “CC\_IF\_BPF\_FLAT” and press **OK** in the list box.
3. Following the Adjustment Program instructions, complete this procedure.

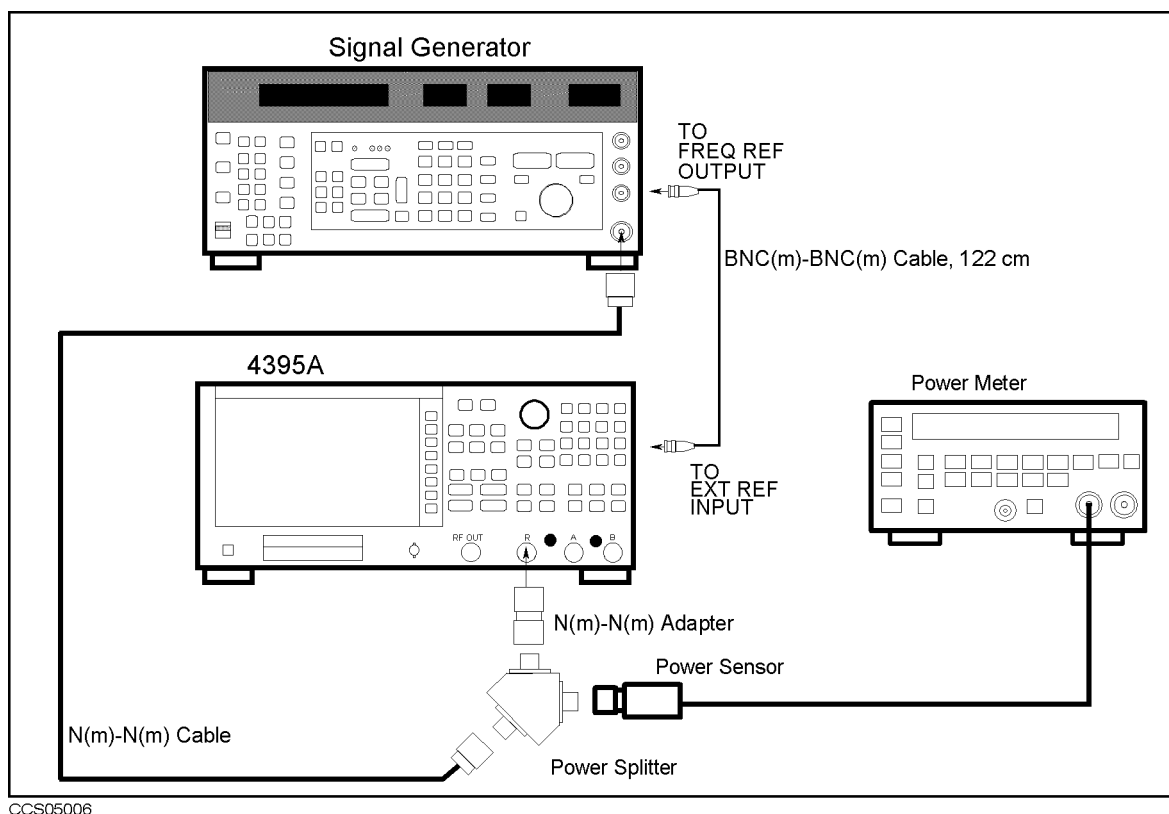


Figure 5-18. IF BPF Flatness Adjustment Setup

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## 15. DC Bias Adjustment (Option 010)

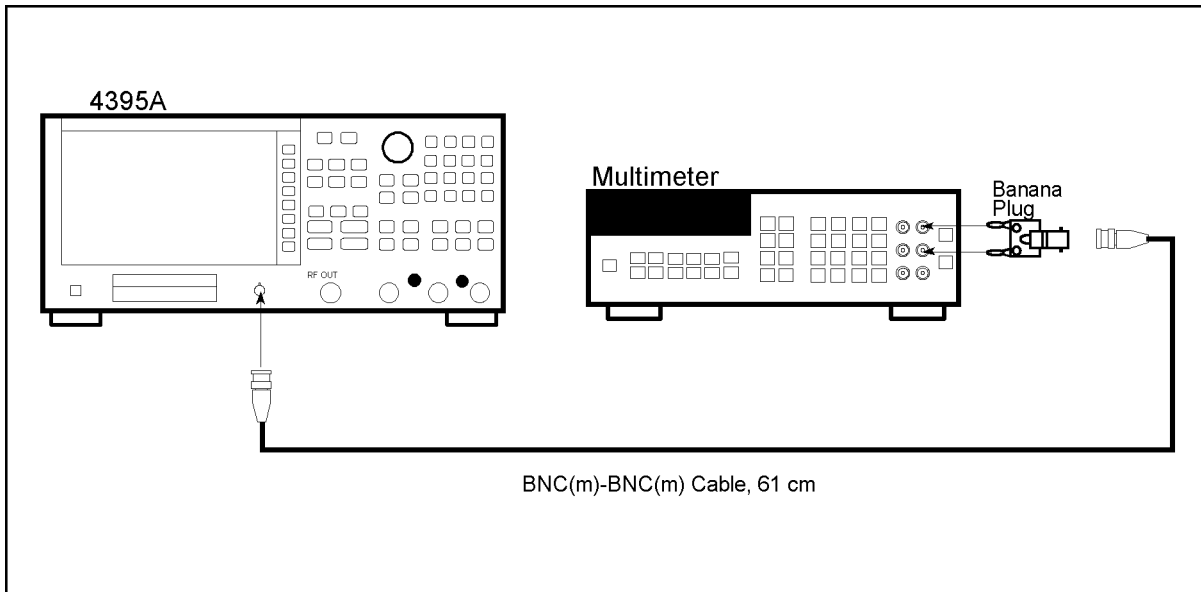
The purpose of this procedure is to adjust the DC Bias source.

### Required Equipment

|                                       |              |
|---------------------------------------|--------------|
| Multimeter .....                      | 3458A        |
| BNC cable, 61 cm .....                | PN 8120-1839 |
| BNC(f)-Dual Banana Plug Adapter ..... | PN 1251-2277 |

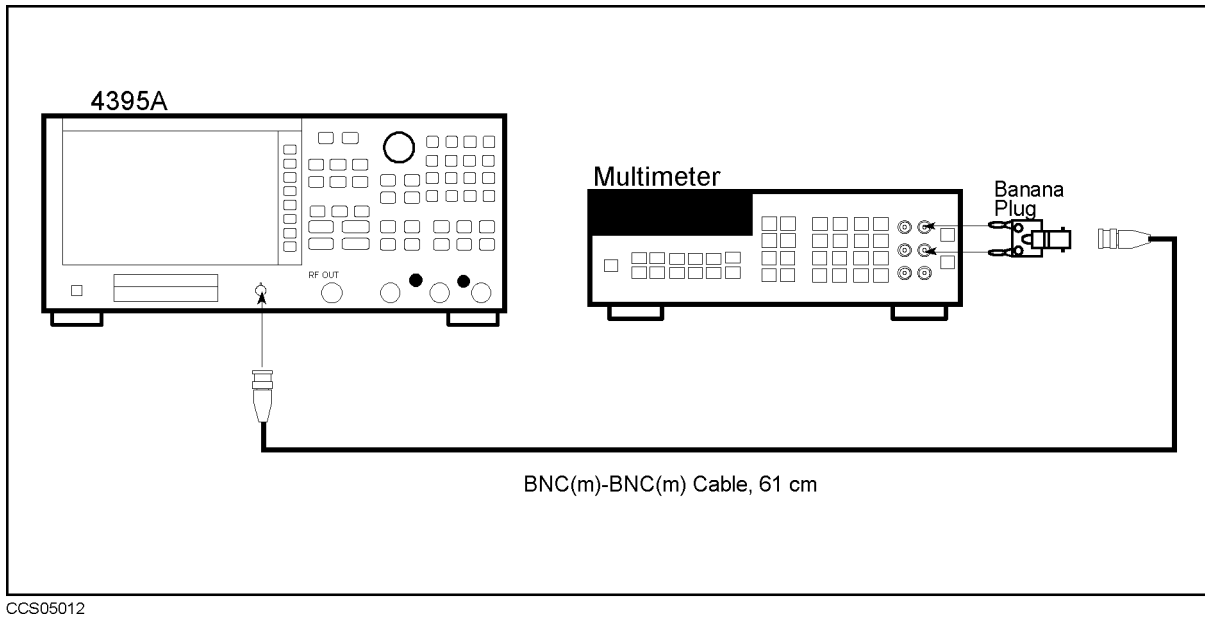
### Procedure

1. Run the Adjustment Program
2. Select the “CC\_DcBias” and press **OK** in the list box.
3. Following the Adjustment Program instructions, complete this procedure.



CCS05011

**Figure 5-19. DC Bias Adjustment Setup 1**



**Figure 5-20. DC Bias Adjustment Setup 2**

## Troubleshooting

---

### INTRODUCTION

This chapter describes troubleshooting flow and provides the procedure to determine which group or an assembly is faulty and should be checked.

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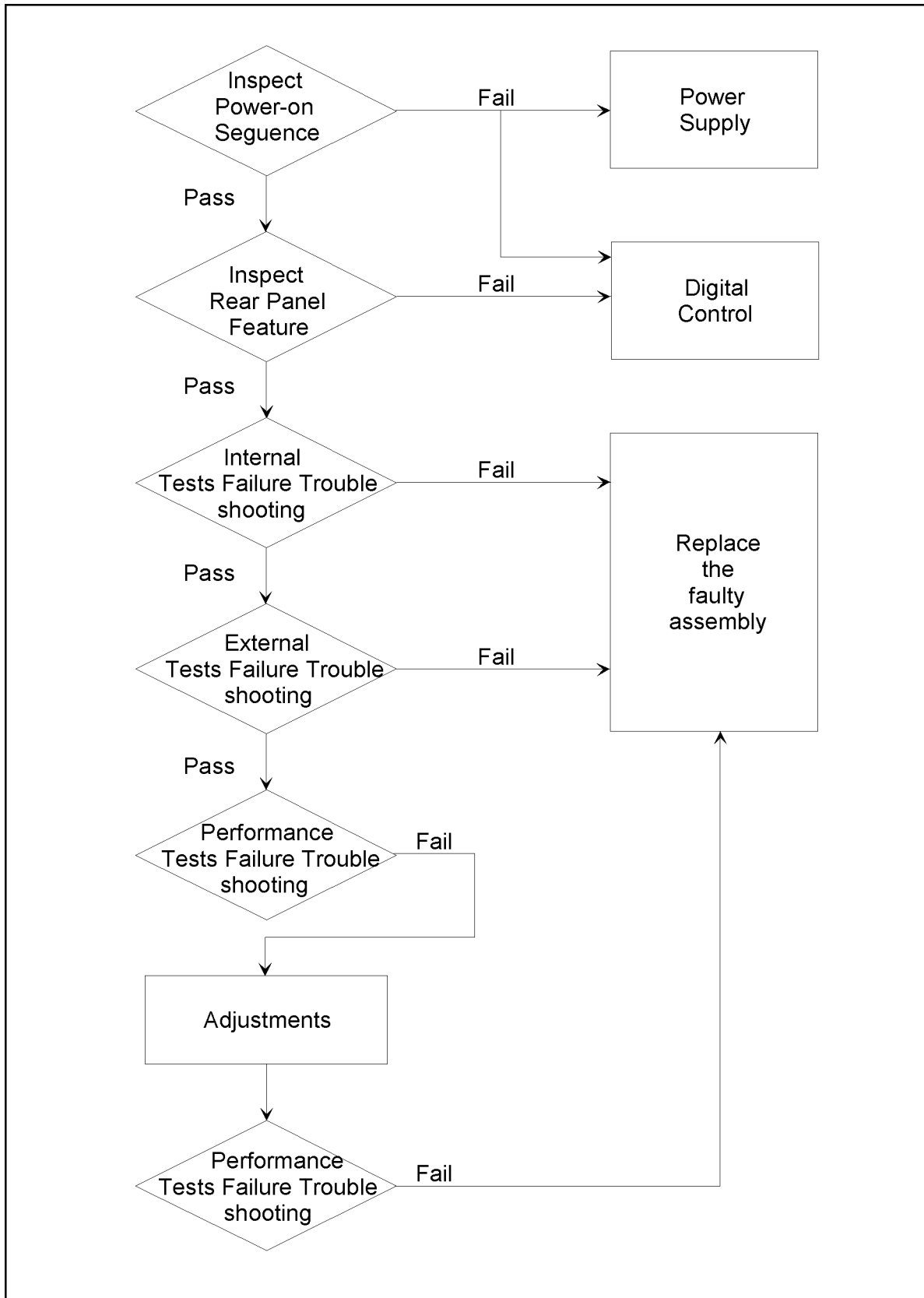
### TROUBLESHOOTING SUMMARY

The troubleshooting strategy of this manual is based on a verification (rather than symptomatic) approach. This chapter describes typical troubleshooting procedure step by step and you can identify a faulty assembly or a faulty group by following the troubleshooting steps sequentially.

And if you could identify only the faulty group, refer to the appropriate chapter following this chapter. Each of following three chapters verifies, one at a time, the assemblies within a group until the faulty assembly is identified. These chapters employ more lengthy, complicated procedures. The three functional groups are power supply, digital control and accessories.

Figure 6-1 diagrams the troubleshooting organization.

*Post-Repair Procedures*, is the last chapter of the troubleshooting portion of the manual. *Post-Repair Procedures* is organized by assembly and notes what adjustment to perform and how to verify proper instrument operation following the replacement of an assembly.



CCS06009

Figure 6-1. Troubleshooting Organization

## 6-2 Troubleshooting



---

## START HERE

This chapter contains following troubleshooting procedures. By performing them in the order listed below, you can identify the faulty assembly or the faulty group efficiently.

1. Disconnect everything from the analyzer: All test set interconnect, GPIB cable, probe power, and RF cables.
2. Perform the *INSPECT THE POWER-ON SEQUENCE* in this chapter.
3. Perform the *INSPECT THE REAR PANEL FEATURE* in this chapter.
4. Perform the *INTERNAL TESTS FAILURE TROUBLESHOOTING* in this chapter.
5. Perform the *EXTERNAL TESTS FAILURE TROUBLESHOOTING* in this chapter.
6. Perform the performance tests in the *Performance Test* chapter and refer to *PERFORMANCE TEST FAILURE TROUBLESHOOTING* in this chapter.

If the analyzer has passed all of the checks but it still making incorrect measurements or unexpected operations, suspect the accessories. Accessories such as RF or interconnect cables, calibration and verification kit devices, test set can all induce system problems.

Configure the system as it is normally used and reconfirm the problem. Continue with the *Accessories Troubleshooting* chapter.

---

## INSPECT THE POWER ON SEQUENCE

### Check the Fan

Turn the analyzer power on. Inspect the fan on the rear panel.

- The fan should be rotating and audible.

If case of unexpected results, check AC line power to the analyzer. Check the fuse (rating listed on the rear panel). Check the line voltage setting. For setting the line voltage, see the *Power Requirements* in Appendix C.

If the problem persists, continue with the *Power Supply Troubleshooting* chapter.

### Check the Front Panel LEDs and Displays

Turn on the analyzer and watch for the following events in this order:

1. Beep is sounding.
2. The **Ch 1** LED turns on and the analyzer displays Internal Test In Progress for several seconds.
3. The analyzer displays the graticule.

If case of unexpected results, continue with *Digital Control Troubleshooting* chapter.

### Check Error Message

Turn the analyzer power on. Inspect the LCD. No error message should be displayed.

If the following status annotation appears on the LCD, the A1 CPU is suspected. Continue with the *Digital Control Troubleshooting* chapter.

- Svc (Status annotation)

If the following error message appears on the LCD, continue with the *INTERNAL TESTS FAILURE TROUBLESHOOTING* in this chapter.

- POWER ON TEST FAILED

These error messages indicate that one of power-on self tests fails. If an other error message appears, refer to the *Error Messages* in Messages.

If the response of front panel, GPIB commands, or built-in FDD is unexpected, continue with the *Digital Control Troubleshooting* chapter.

---

## INSPECT THE REAR PANEL FEATURE

If the analyzer is operating unexpectedly after these checks are verified, continue with *Digital Control Troubleshooting* chapter.

### Check the GPIB Interface

If the unexpected operations appear when controlling the analyzer with an external controller, perform the following checks to verify the problem is not with the controller.

- GPIB interface hardware must be installed in the controller, see the manuals of the controller and the BASIC system.
- I/O and GPIB binaries loaded, see the manuals of the BASIC system.
- Select code, see the manuals of the BASIC system.
- GPIB cables, see the manuals of the BASIC system.
- Programming syntax, see the manuals of the BASIC system.

### Check the Parallel Interface

See the To Print section at the Chapter 8, Analyzing the Measurement Results, of the 4395A User's Guide, and make a hardcopy of the display.

### Check the mini DIN Keyboard Connector

See the Connecting a Keyboard at the Chapter 1, Installation Guide, of the 4395A User's Guide.

---

## Internal Tests Failure Troubleshooting

### Check the Power-On Selftest

The analyzer performs the power-on selftest every time when the analyzer is turned on. In the power-on selftest, some built-in internal tests are executed sequentially. The first failed test indicates the most probable faulty assembly and you should be replaced.

If the power-on selftest fails and “POWER ON TEST FAILED” message is displayed, execute all internal tests to identify the first failed test. Refer to the following steps to execute all internal tests. Then refer to the Table 6-1 to know what assembly you should replace.

### Execute All Internal Tests

If the power-on self test fails and “POWER ON TEST FAILED” message is displayed, you should execute the all internal tests and identify the first failed test. To execute all internal tests, you should specify test number as 0 in the 4395A service tests mode.

- a. Press **PRESET**, **SYSTEM**, **SERVICE TESTS**, **0**, and **x1** to access the internal test 0: ALL INT.
- b. Press **EXECUTE TEST** to execute the ALL INT test.
- c. Wait until the test result, PASS or FAIL, is displayed.
- d. Press the **↑**, **↓** keys to find the first occurrence of a FAIL message.

### Execute the Individual Test

If you would like to perform the internal test individually, you should specify internal test number in the 4395A service tests mode.

- a. Press **PRESET**, **SYSTEM**, **SERVICE TESTS**. Pressing **INTERNAL TESTS** jumps to the first test internal test, test:0 ALL INT.
- b. Select the test using the RPG knob, **↑**, **↓** keys or ENTRY keys.
- c. Press **EXECUTE TEST** to execute the specified test.
- d. Wait until the test result, PASS or FAIL, is displayed.

---

#### Note



Internal test 1, 2, 3, 7, 17, 18, 38 and 39 are not executed in the power-on selftest. You should perform these tests by specifying test number or by executing all internal tests.

---

**Table 6-1. Troubleshooting Information for Internal Test Failure**

| Test No. | First Failed Test                  | Probable Faulty Assembly |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|----------|------------------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
|          |                                    | A1                       | A20 | A30 | A32 | A33 | A40 | A50 | A51 | A2  | A3  | A5  | A7  | A8  | A9  |  |
| 1        | A1 CPU                             | †††                      |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 2        | A1 Volatile Memory                 | †††                      |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 3        | A51 GSP                            |                          |     |     |     |     |     | ††† |     |     |     |     |     |     |     |  |
| 4        | A2 12 V Supply                     |                          | †   |     |     |     | †   | †   |     | ††† |     | †   | †   |     |     |  |
| 5        | A2 Reference Monitor               |                          | †   |     |     |     | †   | †   |     | ††† |     | †   | †   |     |     |  |
| 6        | A2 Board ID                        | †                        | †   |     |     |     |     |     |     | ††† |     |     |     |     |     |  |
| 7        | A3 DAC Output Voltage              |                          | †   |     |     |     | †   | †   |     |     | ††† | †   | †   |     |     |  |
| 8        | A3 +5 V Supply                     |                          | †   |     |     |     | †   | †   |     |     | ††† | †   | †   |     |     |  |
| 9        | A3 −5 V Supply                     |                          | †   |     |     |     | †   | †   |     |     | ††† | †   | †   |     |     |  |
| 10       | A3 +15 V Supply                    |                          | †   |     |     |     | †   | †   |     |     | ††† | †   | †   |     |     |  |
| 11       | A3 −15 V Supply                    |                          | †   |     |     |     | †   | †   |     |     | ††† | †   | †   |     |     |  |
| 12       | A3 Board ID                        | †                        | †   |     |     |     |     |     |     |     | ††† |     |     |     |     |  |
| 13       | A5 15 V Supply                     |                          | †   |     |     |     | †   | †   |     |     |     | ††† | †   | †   |     |  |
| 14       | A5 +5 V Supply                     |                          | †   |     |     |     | †   | †   |     |     |     | ††† | †   | †   |     |  |
| 15       | A5 YTO Power Supply                |                          | †   |     |     |     | †   | †   |     |     |     | ††† | †   | †   |     |  |
| 16       | A5 YTO Control Voltage - Reference |                          |     |     |     |     | †   | †   |     |     |     | ††† | †   | †   |     |  |
| 17       | A5 YTO Control Voltage - Start     |                          |     |     |     |     | †   | †   |     |     |     | ††† | †   | †   |     |  |
| 18       | A5 YTO Control Voltage - Span      |                          |     |     |     |     | †   | †   |     |     |     | ††† | †   | †   |     |  |
| 19       | A5 Temperature Monitor             |                          |     |     |     |     | †   | †   |     |     |     | ††† | †   | †   |     |  |
| 20       | A5 25 MHz Clock                    | †                        |     |     |     |     | †   | †   |     |     |     | ††† |     | †   |     |  |
| 21       | A5 Board ID                        | †                        | †   |     |     |     |     |     |     |     |     | ††† |     |     |     |  |
| 22       | A7 +5 VD Supply                    |                          | †   |     |     |     | †   | †   |     |     |     |     | ††† | †   |     |  |
| 23       | A7 +5 V Supply                     |                          | †   |     |     |     | †   | †   |     |     |     |     | ††† | †   |     |  |
| 24       | A7 −5 V Supply                     |                          | †   |     |     |     | †   | †   |     |     |     |     | ††† | †   |     |  |
| 25       | A7 +12 V Supply                    |                          | †   |     |     |     | †   | †   |     |     |     |     | ††† | †   |     |  |
| 26       | A7 −15 V Supply                    |                          | †   |     |     |     | †   | †   |     |     |     |     | ††† | †   |     |  |
| 27       | A7 25 MHz Local Level              |                          | †   |     |     |     | †   | †   |     |     |     |     | ††† | †   |     |  |
| 28       | A7 25 MHz Freq.                    | †                        |     |     |     |     | †   | †   |     |     |     |     | ††† |     |     |  |
| 29       | A7 Board ID                        | †                        | †   |     |     |     |     |     |     |     |     |     | ††† |     |     |  |
| 30       | A8 ADC Check                       |                          |     |     |     |     | †   | †   |     |     |     |     | †   | ††† |     |  |
| 31       | A8 +24 V Supply                    |                          |     |     |     |     | †   | †   |     |     |     |     | †   | ††  |     |  |
| 32       | A8 +5 VD Supply                    |                          |     |     |     |     | †   | †   |     |     |     |     | †   | ††  |     |  |
| 33       | A8 ±5 V Supply                     |                          |     |     |     |     | †   | †   |     |     |     |     | †   | ††  |     |  |
| 34       | A8 ±15 V Supply                    |                          |     |     |     |     | †   | †   |     |     |     |     | †   | ††  |     |  |
| 35       | A8 +3.3 V Supply                   |                          |     |     |     |     | †   | †   |     |     |     |     | †   | ††  |     |  |
| 36       | A8 ADC Reference Voltage           |                          |     |     |     |     | †   | †   |     |     |     |     | †   | ††  |     |  |
| 37       | A8 25 MHz Clock                    | †                        |     |     |     |     | †   | †   |     |     |     |     | ††  | ††  |     |  |
| 38       | A8 Decimated Clock                 | †                        |     |     |     |     | †   | †   |     |     |     |     | ††  | ††  |     |  |
| 39       | A8 Dither                          |                          | †   |     |     |     | †   | †   |     |     |     |     | †   | ††  |     |  |
| 40       | A8 Board ID                        | †                        | †   |     |     |     |     |     |     |     |     |     |     | ††† |     |  |
| 41       | A9 +5 V Supply                     |                          | †   |     |     |     | †   | †   |     |     |     |     | †   | †   | ††  |  |
| 42       | A9 −5 V Supply                     |                          | †   |     |     |     | †   | †   |     |     |     |     | †   | †   | ††  |  |
| 43       | A9 +15 V Supply                    |                          | †   |     |     |     | †   | †   |     |     |     |     | †   | †   | ††  |  |
| 44       | A9 −15 V Supply                    |                          | †   |     |     |     | †   | †   |     |     |     |     | †   | †   | ††  |  |
| 45       | A9 Board ID                        | †                        | †   |     |     |     |     |     |     |     |     |     |     |     | ††† |  |

†††: Most suspicious assembly and should be checked repalced.

††: Suspicious assembly and should be checked.

†: There is some possibility of a fault.

## External Tests Failure Troubleshooting

If you can't identify the faulty assembly using the internal tests, you can execute the external tests in addition to the internal tests. These external tests are also built-in tests and 10 tests are available in the 4395A service mode. Refer to the Table 6-2 to know which assembly is probable faulty and should be replaced.

To execute the external tests, perform the following procedures.

- Press **PRESET**, **SYSTEM**, **SERVICE TESTS**. Pressing **EXTERNAL TESTS** jumps to the first test external test, test:50 FRONT PANEL DIAG.
- Select the test using the RPG knob, **↑**, **↓** keys or ENTRY keys.
- Press **EXECUTE TEST** to execute the specified test.
- Wait until the test result, PASS or FAIL, is displayed.

**Table 6-2. Troubleshooting Information for External Test Failure**

| Test No. | Failed Test         | Probable Faulty Assembly |     |     |     |     |     |     |     |    |    |    |    |    |    |
|----------|---------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|
|          |                     | A1                       | A20 | A30 | A32 | A33 | A40 | A50 | A51 | A2 | A3 | A5 | A7 | A8 | A9 |
| 50       | FRONT PANEL DIAG    | ††                       |     |     |     |     | †   |     | †   |    |    |    |    |    |    |
| 51       | DSK DR FAULT ISOL'N | ††                       |     |     |     |     | †   |     | †   |    |    |    |    |    |    |
| 52       | 24 BIT I/O PORT     | ††                       |     |     |     |     | †   |     | †   |    |    |    |    |    |    |
| 53       | NA SRC TO R         |                          |     |     |     |     | †   |     | †   |    | †† | †  | †† | †† | †† |
| 54       | NA SRC TO A         |                          |     |     |     |     | †   |     | †   |    | †† | †  | †† | †† | †† |
| 55       | NA AR RATIO         |                          |     |     |     |     | †   |     | †   |    | †† | †  | †† | †† | †† |
| 56       | NA SRC TO B         |                          |     |     |     |     | †   |     | †   |    | †† | †  | †† | †† | †† |
| 57       | NA BR RATIO         |                          |     |     |     |     | †   |     | †   |    | †† | †  | †† | †† | †† |
| 58       | SA LEVEL            |                          |     |     |     |     | †   |     | †   |    |    | †  | †† | †† | †† |
| 59       | SA PHASE NOISE      |                          |     |     |     |     | †   |     | †   |    |    | †† | †  | †  | †  |

††: Most suspicious assembly and should be replaced.

†: Suspicious assembly and should be checked.

## Performance Tests Failure Troubleshooting

Perform the following procedure sequentially when any of performance tests fail.

### Perform Adjustments and Correction Constants

Table 6-3 gives the recommended adjustments and correction constants when a performance test fails. If a performance test fails, you should perform the corresponding adjustments or correction constants function as shown in Table 6-3. If the tests still fail, refer to Table 6-4 and replace the assembly.

Note that this table lists some typical cases. In a few cases, other assembly may actually be faulty.

**Table 6-3. Troubleshooting Information for Performance Test Failure 1**

| Test No. | Failed Test                                   | Adjustment Test Number |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|----------|-----------------------------------------------|------------------------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
|          |                                               | 1                      | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 1        | Frequency Accuracy Test                       | ✓                      |   | ✓ | ✓ | ✓ |   |   |   | ✓ |    | ✓  |    |    | ✓  |    |
| 2        | Source Level Accuracy/Flatness Test           | ✓                      |   | ✓ | ✓ | ✓ |   |   |   | ✓ |    | ✓  |    |    | ✓  |    |
| 3        | Non-sweep Linearity Test                      | ✓                      |   | ✓ | ✓ | ✓ |   |   |   | ✓ |    | ✓  |    |    | ✓  |    |
| 4        | Power Sweep Linearity Test                    | ✓                      |   | ✓ | ✓ | ✓ |   |   |   | ✓ |    | ✓  |    |    | ✓  |    |
| 5        | Harmonics/Non-harmonic Test                   | ✓                      |   | ✓ | ✓ | ✓ |   |   |   | ✓ |    | ✓  |    |    | ✓  |    |
| 6        | DC Bias Test                                  |                        |   |   |   |   |   |   |   |   |    |    |    |    |    | ✓  |
| 7        | Receiver Noise Level Test                     | ✓                      |   | ✓ | ✓ | ✓ |   |   | ✓ | ✓ | ✓  | ✓  |    |    | ✓  |    |
| 8        | Input Crosstalk Test                          |                        |   |   | ✓ | ✓ | ✓ | ✓ |   |   |    |    | ✓  | ✓  |    |    |
| 9        | Input Impedance Test                          |                        |   |   | ✓ | ✓ | ✓ | ✓ |   |   |    |    | ✓  | ✓  |    |    |
| 10       | Absolute Amplitude Accuracy Test              | ✓                      |   | ✓ |   |   | ✓ | ✓ | ✓ | ✓ | ✓  | ✓  | ✓  | ✓  | ✓  |    |
| 11       | Magnitude Ratio/Phase Dynamic Accuracy Test   | ✓                      |   |   |   |   | ✓ | ✓ | ✓ | ✓ | ✓  |    | ✓  | ✓  | ✓  |    |
| 12       | Magnitude Ratio/Phase Frequency Response Test | ✓                      |   |   |   |   | ✓ | ✓ | ✓ | ✓ | ✓  |    | ✓  | ✓  | ✓  |    |
| 13       | Displayed Average Noise Level Test            | ✓                      |   | ✓ |   |   | ✓ | ✓ | ✓ | ✓ | ✓  | ✓  | ✓  | ✓  | ✓  |    |
| 14       | Amplitude Fidelity Test                       | ✓                      |   |   |   |   | ✓ | ✓ | ✓ | ✓ | ✓  | ✓  | ✓  | ✓  | ✓  |    |
| 15       | Input Attenuator Switching Uncertainty Test   |                        |   |   |   |   | ✓ | ✓ |   |   |    |    | ✓  | ✓  |    |    |
| 16       | Noise Sidebands Test                          | ✓                      |   | ✓ |   |   |   |   | ✓ | ✓ | ✓  | ✓  |    |    |    |    |
| 17       | Amplitude Accuracy/Frequency Response Test    | ✓                      |   |   |   |   | ✓ | ✓ | ✓ | ✓ | ✓  | ✓  | ✓  | ✓  | ✓  |    |
| 18       | Second Harmonic Distortion Test               |                        |   | ✓ |   |   | ✓ | ✓ |   |   |    |    | ✓  | ✓  |    |    |
| 19       | Third Order Intermodulation Distortion Test   | ✓                      |   | ✓ |   |   | ✓ | ✓ | ✓ | ✓ | ✓  | ✓  | ✓  | ✓  | ✓  |    |
| 20       | Other Spurious Test                           | ✓                      |   | ✓ |   |   | ✓ | ✓ | ✓ | ✓ | ✓  | ✓  | ✓  | ✓  | ✓  |    |
| 21       | Residual Response Test                        | ✓                      |   | ✓ |   |   | ✓ | ✓ | ✓ | ✓ | ✓  | ✓  | ✓  | ✓  | ✓  |    |

**Table 6-4. Troubleshooting Information for Performance Test Failure 2**

| Test No. | Failed Test                                   | Probable Faulty Assembly |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----------|-----------------------------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|          |                                               | A1                       | A20 | A30 | A32 | A33 | A40 | A50 | A51 | A2  | A3  | A5  | A7  | A8  | A9  |
| 1        | Frequency Accuracy Test                       | †                        | †   |     |     |     | ††  | ††  |     |     | ††† | ††  | ††  |     |     |
| 2        | Source Level Accuracy/Flatness Test           | †                        | †   |     |     |     | ††  | ††  |     |     | ††† | ††  | ††  |     |     |
| 3        | Non-sweep Linearity Test                      | †                        | †   |     |     |     | ††  | ††  |     |     | ††† | ††  | ††  |     |     |
| 4        | Power Sweep Linearity Test                    | †                        | †   |     |     |     | ††  | ††  |     |     | ††† | ††  | ††  |     |     |
| 5        | Harmonics/Non-harmonic Test                   | †                        | †   |     |     |     | ††  | ††  |     |     | ††† | ††  | ††  |     |     |
| 6        | DC Bias Test                                  | †                        | †   |     |     |     | ††  |     |     | ††† |     |     |     |     |     |
| 7        | Receiver Noise Level Test                     | †                        | †   |     |     |     | ††  | ††  |     |     |     | †   | ††  | ††  | ††  |
| 8        | Input Crosstalk Test                          | †                        | †   |     |     |     | ††  | ††  |     |     | ††† | †   |     |     | ††† |
| 9        | Input Impedance Test                          |                          |     |     |     |     |     |     |     |     | ††† |     |     |     | ††† |
| 10       | Absolute Amplitude Accuracy Test              | †                        | †   |     |     |     | ††  | ††  |     |     |     | ††† | ††† | ††† | ††† |
| 11       | Magnitude Ratio/Phase Dynamic Accuracy Test   | †                        | †   |     |     |     | ††  | ††  |     |     |     | †   | ††  | ††† | ††  |
| 12       | Magnitude Ratio/Phase Frequency Response Test | †                        | †   |     |     |     | ††  | ††  |     |     |     | †   | ††  | ††† | ††  |
| 13       | Displayed Average Noise Level Test            | †                        | †   |     |     |     | ††  | ††  |     |     |     | ††  | ††† | ††† | ††† |
| 14       | Amplitude Fidelity Test                       | †                        | †   |     |     |     | ††  | ††  |     |     |     | ††  | ††† | ††† | ††† |
| 15       | Input Attenuator Switching Uncertainty Test   | †                        | †   |     |     |     | ††  | ††  |     |     |     | †   | †   | †   | ††† |
| 16       | Noise Sidebands Test                          | †                        | †   |     |     |     | ††  | ††  |     |     |     | ††† | ††† | ††† |     |
| 17       | Amplitude Accuracy/Frequency Response Test    | †                        | †   |     |     |     | ††  | ††  |     |     |     | ††  | ††† | ††† | ††† |
| 18       | Second Harmonic Distortion Test               | †                        | †   |     |     |     | ††  | ††  |     |     |     | ††  |     |     | ††† |
| 19       | Third Order Intermodulation Distortion Test   | †                        | †   |     |     |     | ††  | ††  |     |     |     | ††  | ††† | ††† | ††  |
| 20       | Other Spurious Test                           | †                        | †   |     |     |     | ††  | ††  |     |     |     | ††  | ††† | ††† | ††  |
| 21       | Residual Response Test                        | †                        | †   |     |     |     | ††  | ††  |     |     |     | ††† | ††† | ††  | ††  |

†††: Most suspicious assembly and should be replaced.

††: Suspicious assembly and should be checked.

†: There is some possibility of a fault.



## Power Supply Troubleshooting

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### INTRODUCTION

Use this procedure only if you have read *Troubleshooting*, and you believe the problem is in the power supply. The procedure is designed to let you identify the bad assembly within the power supply functional group in the shortest possible time.

The power supply functional group consists of:

- A40 Pre-Regulator
- A50 DC-DC Converter

All assemblies, however, are related to the power supply functional group because power is supplied to each assembly. Figure 7-1 shows all power lines in simplified block diagram form.

If an assembly is replaced, see *Post Repair Procedures* in the *Post Repair Procedures* chapter in this manual. It tells what additional tests or adjustments need to be done after replacing any assembly.



## 7-2 Power Supply Troubleshooting

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## START HERE

### 1. Check the Fan is Rotating

Look at the fan on the rear panel. Check the fan is rotating.

- If the fan is not rotating, continue with the *FIND OUT WHY THE FAN IS NOT ROTATING* in this chapter.
- If the fan is rotating, continue with the next *Check the A50 SHUTDOWN LED*.

### 2. Check the A50 SHUTDOWN LED

There is a LED, SHUTDOWN LED, on the A50 DC-DC Converter. Perform the following procedure to check it. The SHUTDOWN LED is described in the next *A50 SHUTDOWN LED*.

- a. Turn the analyzer power off.
- b. Remove the analyzer's top cover and shield plate.
- c. Turn the analyzer power on.
- d. Look at the A50 SHUTDOWN LED. The LED is normally on. The SHUTDOWN LED location on A50 DC-DC Converter is shown in Figure 7-2.
  - If the A50 SHUTDOWN LED is off, continue with the *FIND OUT WHY THE A50 SHUTDOWN LED IS OFF* in this chapter.
  - If the A50 SHUTDOWN LED is on, continue with the *Check the A1 +5 VD LED* in this procedure.

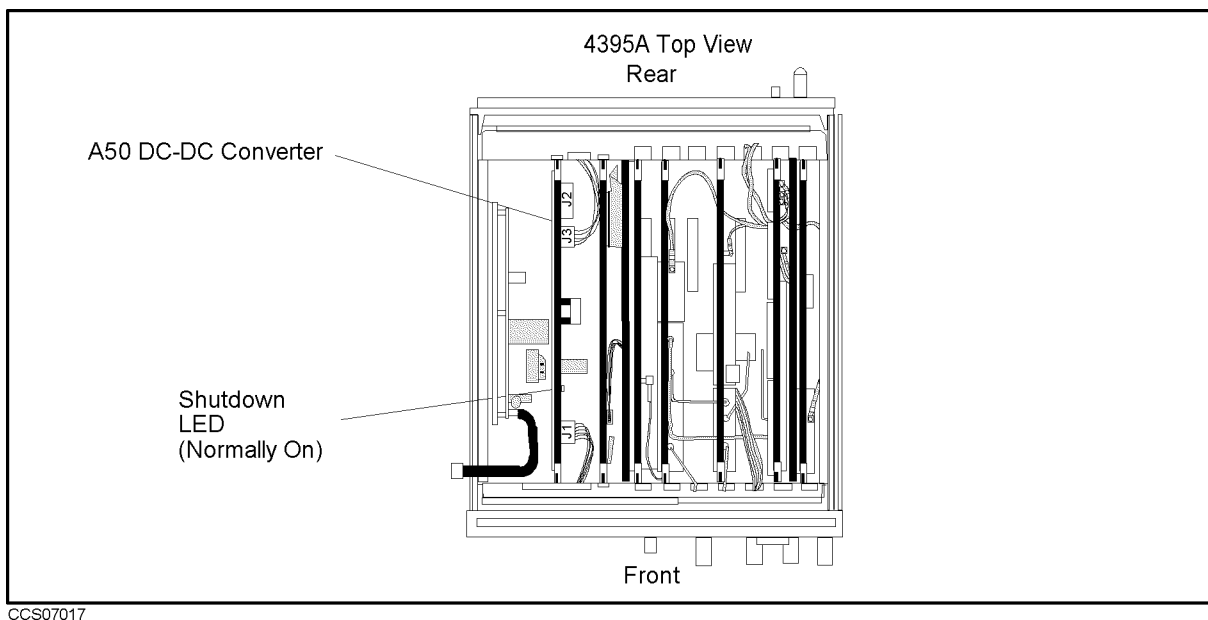


Figure 7-2. A50 SHUTDOWN LED Location

## A50 Shutdown LED

The A50 SHUTDOWN LED turning off indicates some of A50 power supply is shut down by the A50 shutdown circuitry.

There are two FAN conditions, rotating and not rotating when the SHUTDOWN LED turns off. When the fan is rotating, the shutdown circuit is probably activated by the over current condition on the power lines in the A50 DC-DC Converter. In this condition, though the A50 power supplies, +24 V, +5 VD, +18 V, +7.8 V, -7.8 V, and -18 V are shut down, the Fan Power +24 V is still supplied to the fan. When the fan is not rotating, the shutdown circuit is probably activated by the FAN LOCK signal missing.

### Note



Once the A50 shutdown circuit is activated, the only way to reset the circuit is turning the analyzer power off. Wait a minute after turning the analyzer off. Then turn it on.

## 3. Check the A1 +5 VD LED

- Remove the analyzer's bottom cover.
- Turn the analyzer power on.
- Look at the +5 VD LED. The +5 VD LED location on A1 CPU is shown in Figure 7-3. The LED is normally on.
  - If the +5 VD LED is off, continue with the *FIND OUT WHY THE A1 +5 VD LED IS NOT ON STEADILY* in this chapter.
  - If the +5 VD LED is on, the +5 VD power supply is verified with 95% confidence level. If you want to confirm the last 5% uncertainty, perform steps in the next *Measure the A1 +5 VD Voltage*.

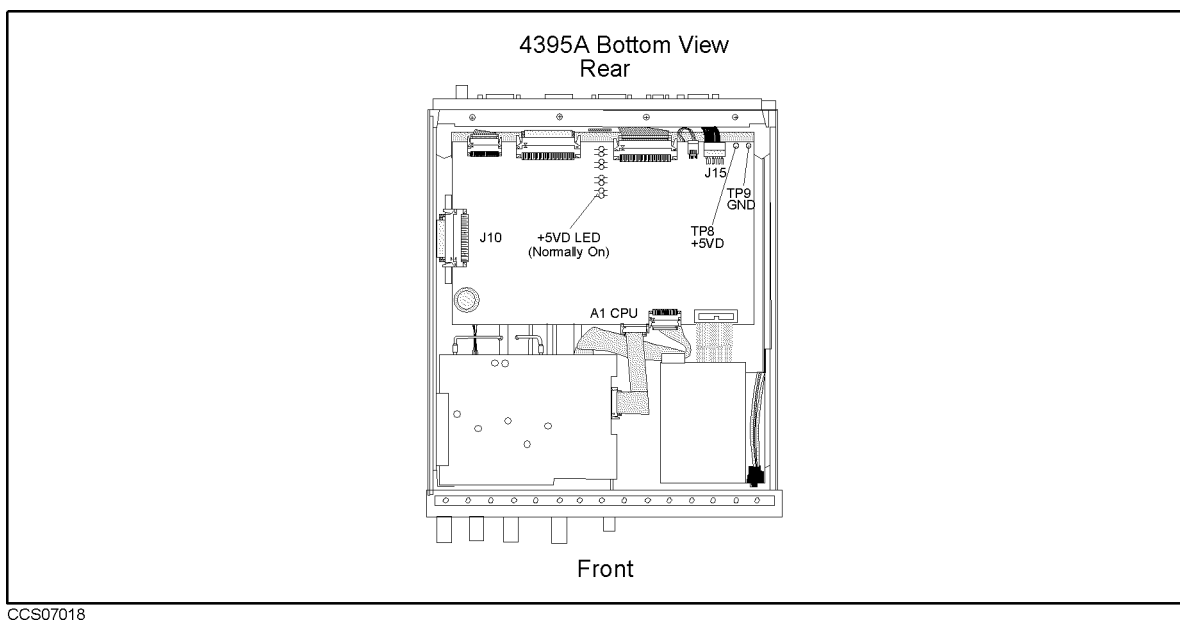


Figure 7-3. A1 +5 VD LED Location

**Measure the A1 +5 VD Voltage**

Measure the DC voltage on a test point A1TP8 (+5 VD) using a voltmeter. Check the voltmeter reading is within 4.59 V to 5.61 V.

- If the voltmeter reading is out of the limits, continue with the *FIND OUT WHY THE A1 LED IS NOT ON STEADILY*.
- If the voltmeter reading is within the limits, continue with the next step.

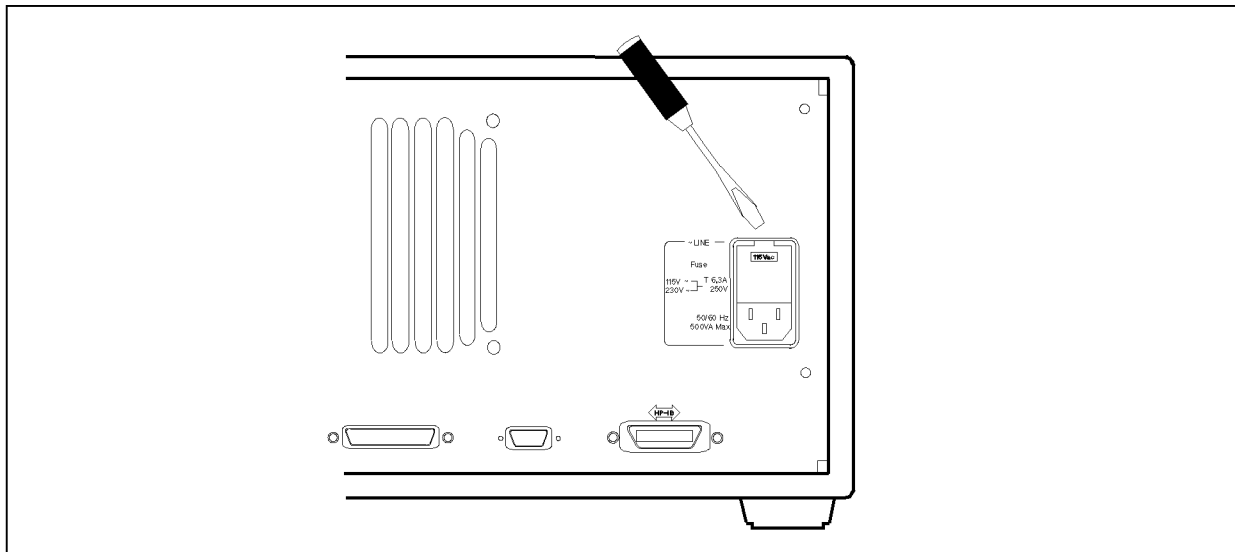
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## FIND OUT WHY THE FAN IS NOT ROTATING

If the fan is not rotating, the problem may be in the A40 pre-regulator, the A50 DC-DC Converter or the fan.

### 1. Check the Line Voltage, Selector Switch Setting, and Fuse

Check the main power line cord, line fuse, and actual line voltage to see that they are all correct. Figure 7-4 shows how to remove the line fuse, using a small flat-bladed screwdriver to pry off the fuse holder. For more information about the line cord and line fuse, see the *Power Requirements* in Appendix C.



CBS05010

Figure 7-4. Removing Line Fuse

### 2. Check the A50 SHUTDOWN LED

When the fan stops, the A50 SHUTDOWN LED is off. The fan generates a FAN LOCK signal. The signal is fed into the FAN LOCK SENSE circuit in the A50 DC-DC converter. If the FAN stops, the FAN LOCK signal is missing. Then the FAN LOCK SENSE circuit activates the A50 shutdown circuitry, resulting the SHUTDOWN LED turned off.

Perform the following procedure to check the A50 SHUTDOWN LED on.

- a. Remove the analyzer's top cover and shield plate.
- b. Turn the analyzer power on.
- c. Look at the A50 SHUTDOWN LED. The LED location is shown in Figure 7-2.
  - If the SHUTDOWN LED is on, replace the A50 DC-DC Converter.
  - If the SHUTDOWN LED is off, continue with the *TROUBLESHOOT THE FAN AND THE A50 DC-DC Converter* in this chapter.

---

## FIND OUT WHY THE A50 SHUTDOWN LED IS OFF

Use this procedure when the fan is rotating. If the fan is not rotating, see the *FIND OUT WHY THE FAN IS NOT ROTATING*.

If the fan is rotating and the A50 SHUTDOWN LED is off, the problem may be in the A50 DC-DC Converter and any of assemblies obtaining the power from +5 VD supply and the higher power supplies.

### 1. Disconnect the Cable from the A1J10

Turn the analyzer power off. Disconnect the cable from A1J10. Turn the analyzer power on.

- If the A50 SHUTDOWN LED goes on, replace the A1 CPU.
- If the A50 SHUTDOWN LED is still off, the A1 CPU is verified. Turn the analyzer power off and reconnect the cable to the A1J10. Continue with the next *Remove Assemblies*.

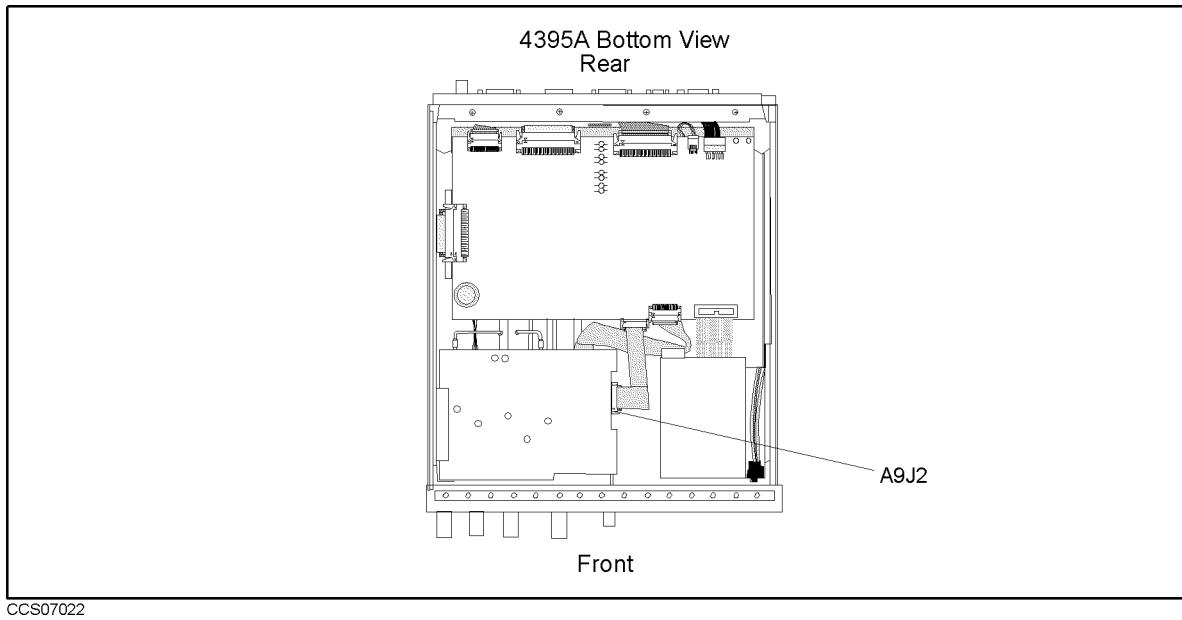
### 2. Remove Assemblies

- a. Turn the analyzer power off.
- b. Remove the assemblies, A2, A3, A5, A7, A8 and A51.
- c. Turn the analyzer power on.
  - If the A50 SHUTDOWN LED is still off, inspect the A20 motherboard for soldering bridges and shorted traces on the FAN POWER and the FAN LOCK signal paths.
  - If the A50 SHUTDOWN LED goes on, the A20 motherboard are verified. Continue with the next step.
- d. Reinstall each assembly one at a time. Turn the analyzer power on after each is installed. The assembly that causes the A50 SHUTDOWN LED to go off is the most probable faulty assembly. Replace the assembly. If no assembly makes the A50 SHUTDOWN LED off, continue with the next *Disconnect the Cable from the A9J2*.

### 3. Disconnect the Cable from the A9J2

Turn the analyzer power off and reinstall all of assemblies. Disconnect the cable from the A9J2 and turn the analyzer power on. The location of the A9J2 is shown in the Figure 7-5.

- If the A50 SHUTDOWN LED goes off, the A9 is faulty. Replace the A9 assembly.



**Figure 7-5. A1 CPU Connector Locations**



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## FIND OUT WHY THE A1 +5 VD LED IS NOT ON STEADILY

If the +5 VD LED is not on steadily, the +5 VD line voltage is missing or is not enough to power the analyzer. The problem may be in the A40 pre-regulator, the A50 DC-DC Converter, the A1 CPU, and any of assemblies obtaining the power from +5 VD supply.

### 1. Check the A40 Pre-Regulator

- a. Turn the analyzer power off.
- b. Disconnect a cable form the A50J1. The A50J1 location is shown in Figure 7-6.
- c. Turn the analyzer power on.
- d. Check the voltage between the pin 1 and pin 6(GND) of the cable within +22.0 V to +27.0 V using a voltmeter with a small probe.
  - If the voltmeter reading is out of the limits, replace the A40 pre-regulator.
  - If the voltmeter reading is within the limits, the A40 pre-regulator is verified. Turn the analyzer power off and reconnect the cable to the A50J1. Then continue with the next *Check the A50 DC-DC Converter* section.

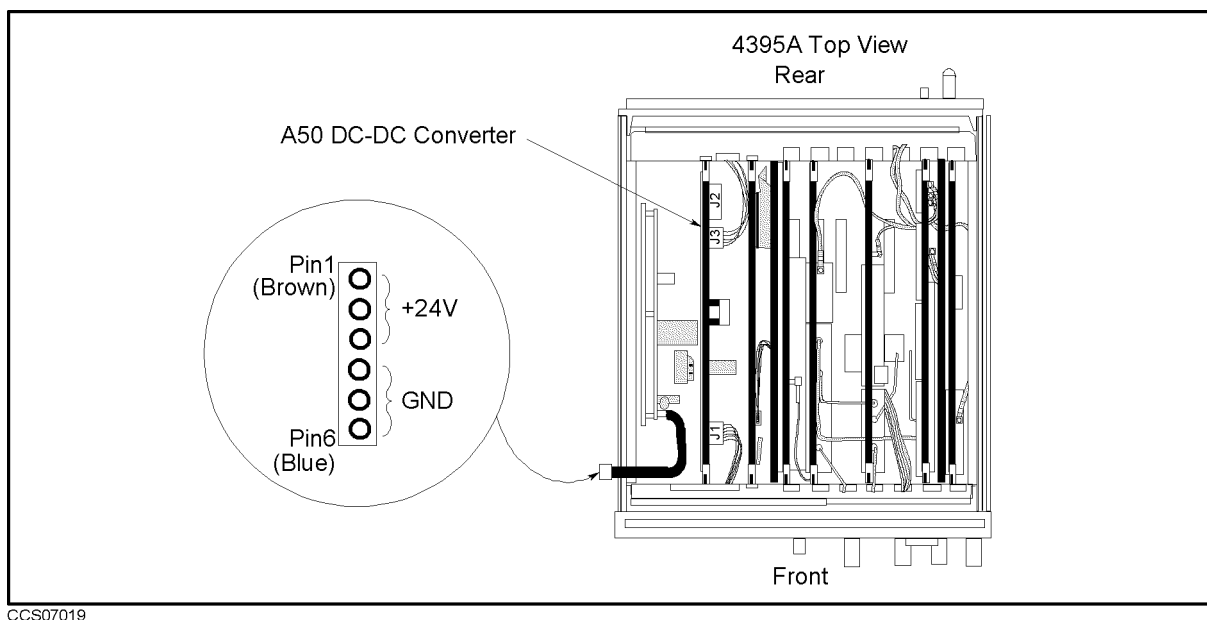


Figure 7-6. A40J1 Output Voltage

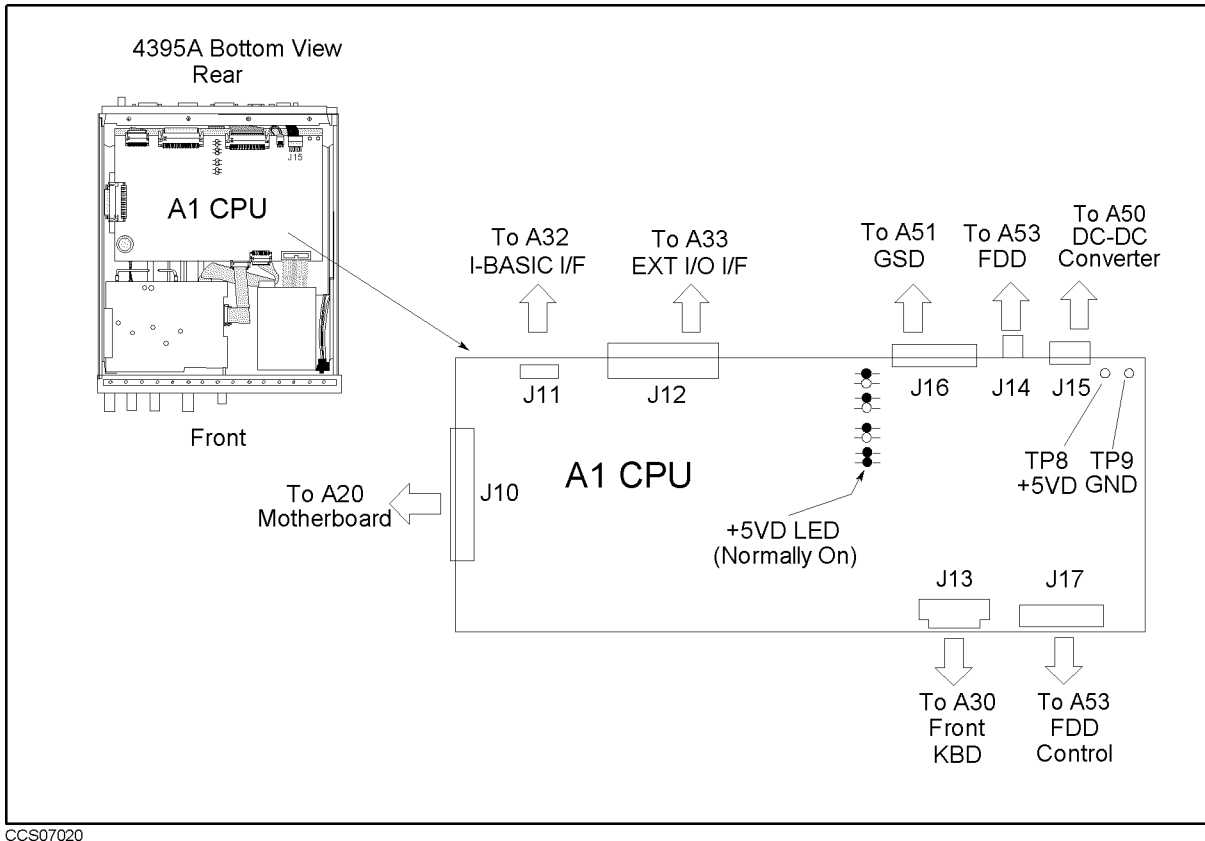
### 2. Check the A50 DC-DC Converter

- a. Turn the analyzer power off.
- b. Disconnect a cable form the A50J3. The A50J3 location is shown in Figure 7-6.
- c. Turn the analyzer power on.
- d. Check the voltage between the A50J3 pin 1 and pin 6(GND) within +4.59 V to +5.61 V using a voltmeter with a small probe.
  - If the voltmeter reading is out of the limits, replace the A50 DC-DC Converter.

- If the voltmeter reading is within the limits, the A50 +5 VD power supply is verified. Turn the analyzer power off and reconnect the cable to the A50J3. Then continue with the next *Disconnect Cables on the A1 CPU* section.

### 3. Disconnect Cables on the A1 CPU

- a. Turn the analyzer power off.
- b. Disconnect cables from the A1 CPU's connectors, J10, J11, J12, J13, J14, J15, and J17. The connector locations are shown in Figure 7-7



**Figure 7-7. A1 CPU Connector Locations**

- c. Turn the analyzer power on. Look at the A1 +5 VD LED.
  - If the LED is still off, the A1 CPU is probably faulty. Replace the A1 CPU.
  - If the LED goes on, the A1 CPU is verified. Continue with the next step.
- d. Turn the analyzer power off. Reconnect the cable to the A1J10. Turn the analyzer power on. Look at the A1 +5 VD LED.
  - If the +5 VD LED goes out, the problem may be in the analog assemblies. Continue with the next *Remove Assemblies*.
  - If the + 5 VD LED is still on, continue with the next step.
- e. Reconnect one of the disconnected cables to its connector at a time. Turn the analyzer power on after each cable is connected. The assembly related with the cable turning the +5 VD LED off is probably faulty. Replace the assembly.

## 7-10 Power Supply Troubleshooting

#### **4. Remove Assemblies**

- a. Turn the analyzer power off. Remove the assemblies, A2, A3, A5, A7, A8 and A51.
- b. Turn the analyzer power on. Look at the A1 +5 VD LED.
  - If the LED is still off, inspect the A20 motherboard.
  - If the LED goes on, the A20 motherboard are verified. Continue with the next step.
- c. Reinstall one of the removed assemblies at a time. Turn the analyzer power on after each is installed. The assembly that turns the A1 +5 VD LED on is the most probable faulty assembly. Replace the assembly.

#### **5. Remove Assemblies**

- a. Turn the analyzer power off. Remove the assemblies, A2, A3, A5, A7, A8, A51 and A9J2.
- b. Turn the analyzer power on. Look at the A1 +5 VD LED.
  - If the LED is still off, inspect the A20 motherboard.
  - If the LED goes on, the A20 motherboard are verified. Continue with the next step.
- c. Reinstall one of the removed assemblies at a time. Turn the analyzer power on after each is installed. The assembly that turns the A1 +5 VD LED on is the most probable faulty assembly. Replace the assembly.

## TROUBLESHOOT THE FAN AND THE A50 DC-DC CONVERTER

Perform the following procedure to troubleshoot the fan and the A50 DC-DC Converter.

### 1. Troubleshoot the Fan

- a. Turn the analyzer power off.
- b. Disassemble the rear panel.
- c. Remove the fan power cable from the Motherboard A20J18.
- d. Connect a DC power supply, a 10 k $\Omega$  resistance, and a oscilloscope to the fan power cable using appropriate wires as shown in Figure 7-8.

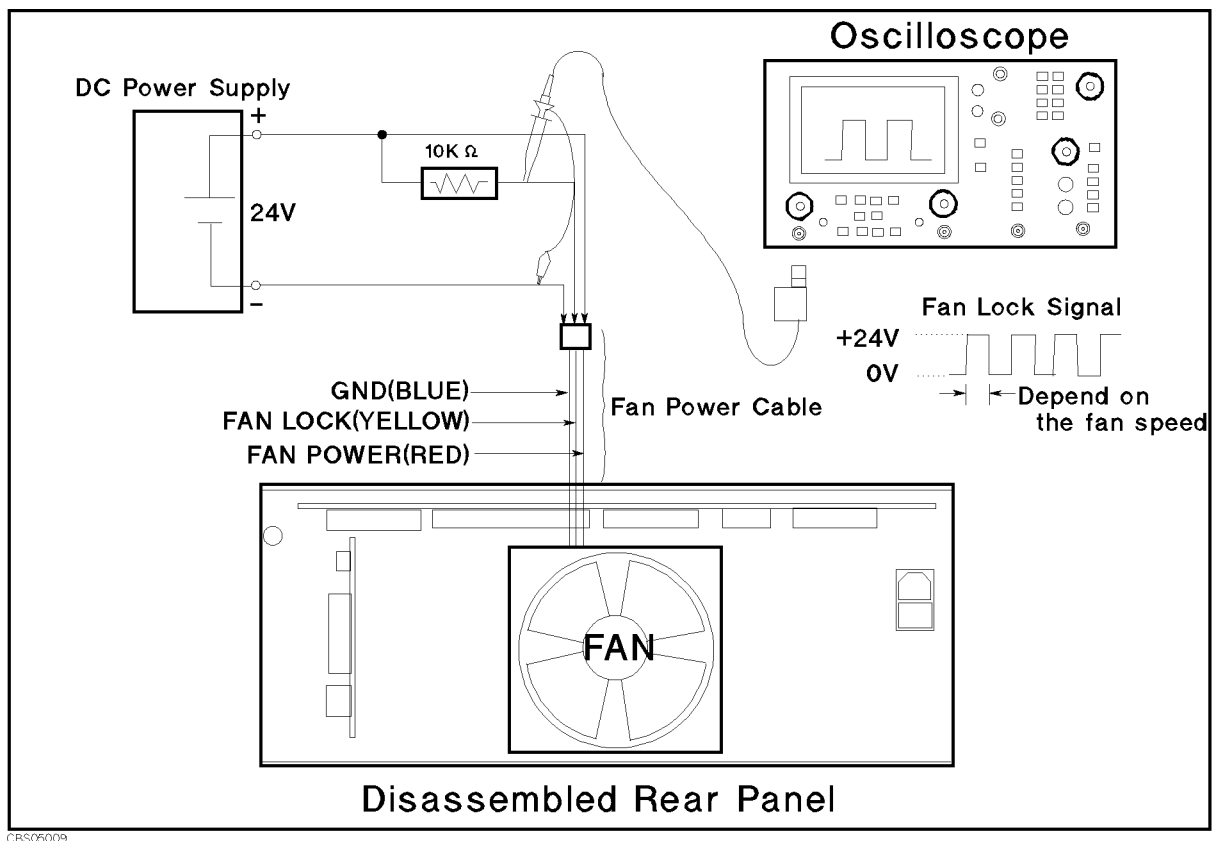
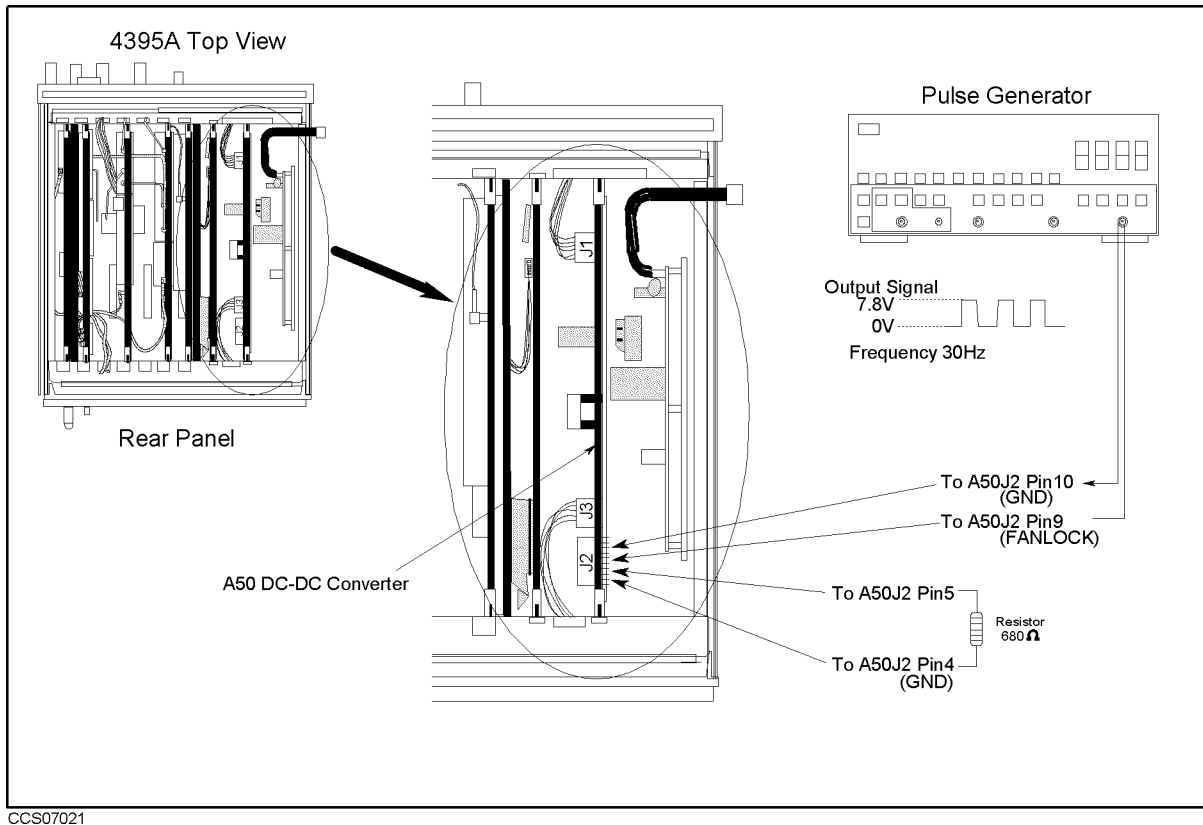


Figure 7-8. Fan Troubleshooting Setup

- e. Turn the DC power supply on. Adjust the output voltage to +24 V.
- f. Check the fan is rotating. Check the FAN LOCK signal is as shown in Figure 7-8.
  - If the fan is not rotating or the FAN LOCK signal is unexpected, replace the fan.
  - If these are good, the fan is verified.
  - Reconnect the fan power cable to the Motherboard A20J18.

## 2. Troubleshoot the A50 DC-DC Converter



**Figure 7-9. A50 DC-DC Converter Troubleshooting Setup**

- Turn the analyzer power off.
- Disconnect cables from the A50J3. The connector locations are shown in Figure 7-9
- Connect the pulse generator to the A50J2 as shown in Figure 7-9. The pulse generator is used to feed the substitute of the FAN LOCK signal to the A50 DC-DC converter. This purposes not to shut down the A50 DC-DC converter.
- Turn the pulse generator power on. Set the controls as follows:
 

|           |                     |
|-----------|---------------------|
| Wave Form | Square              |
| Frequency | Approximately 30 Hz |
| Amplitude | +7.8 V              |
- Connect a resister (appoximately 680ohms, 125mW) between the A50J2 pin 5 (+7.8 V) and pin 4(GND) as shown in Figure 7-9.
- Turn the analyzer power on.
- Measure all power supply voltages on A50J2 and A50J3 using a voltmeter with a small probe. See the Table 7-1 for power lines, connector pins, and limits.

**Table 7-1. A50 Power Supplies**

| Supply | Connector Pin         | GND Connector Pin     | Range              |
|--------|-----------------------|-----------------------|--------------------|
| +5 VD  | A50J3 Pin 1, 2, and 3 | A50J3 Pin 4, 5, and 6 | +4.6 V to +5.7 V   |
| -18 V  | A50J2 Pin 1           | A50J2 Pin 3 and 4     | -14.0 V to -27.0 V |
| +18 V  | A50J2 Pin 2           | A50J2 Pin 3 and 4     | 14.0 V to 27.0 V   |
| +7.8 V | A50J2 Pin 5           | A50J2 Pin 3 and 4     | 7.0 V to 9.0 V     |
| -7.8 V | A50J2 Pin 6           | A50J2 Pin 3 and 4     | -6.0 V to -12.0 V  |
| +24 V  | A50J2 Pin 8           | A50J2 Pin 10          | 22.0 V to 27.0 V   |

- If any of the power supply voltages are out of the limits, replace the A50 DC-DC Converter.
- If all A50 power supply voltages are good, the A50 pre-regulator is verified.

## Digital Control Troubleshooting

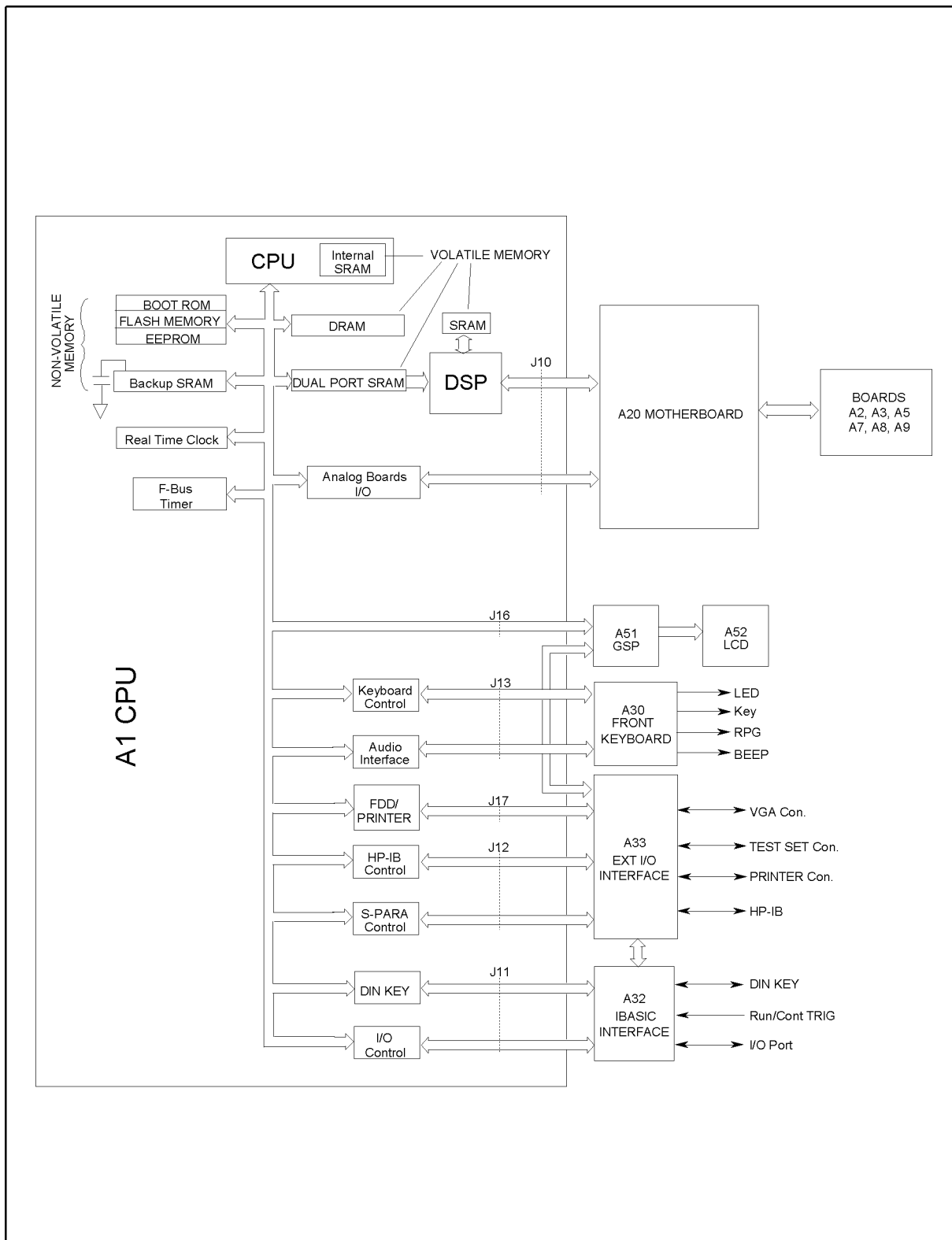
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### INTRODUCTION

Use this procedure only if you have followed the procedures in the *Troubleshooting* chapter, and believe the problem to be in the digital control group. This procedure is designed to let you identify the bad assembly within the digital control group in the shortest possible time. Whenever an assembly is replaced in this procedure, refer to the *Table of Related Service Procedures* in the *Post-Repair Procedures* chapter in this manual.

Figure 8-1 shows the digital control group in simplified block diagram form. The following assemblies make up the digital control group:

- A1 CPU
- A30 Front Keyboard
- A32 I-BASIC Interface
- A33 EXT I/O Interface
- A51 GSP
- A52 LCD (Liquid Crystal Display)
- A53 FDD



CCS08011

**Figure 8-1. Digital Control Group Simplified Block Diagram**

## 8-2 Digital Control Troubleshooting

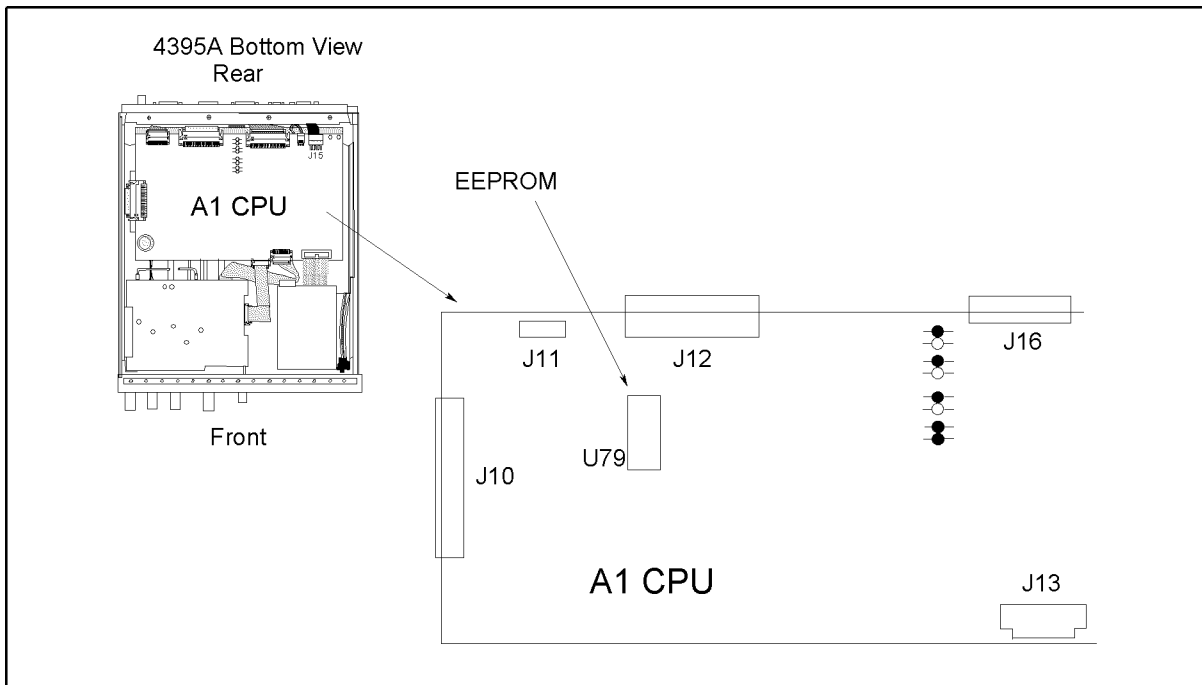


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## A1 CPU Replacement

When you replace a faulty A1 CPU with a new one, remove the EEPROM from the faulty A1 and mount the EEPROM on the replacement A1.

In the EEPROM, the correction constants data is stored after performing the Adjustment and Correction Constants procedures described in the chapter 5. The data may be valid for the new A1 CPU.



CCS08012

**Figure 8-2. A1 EEPROM Location**

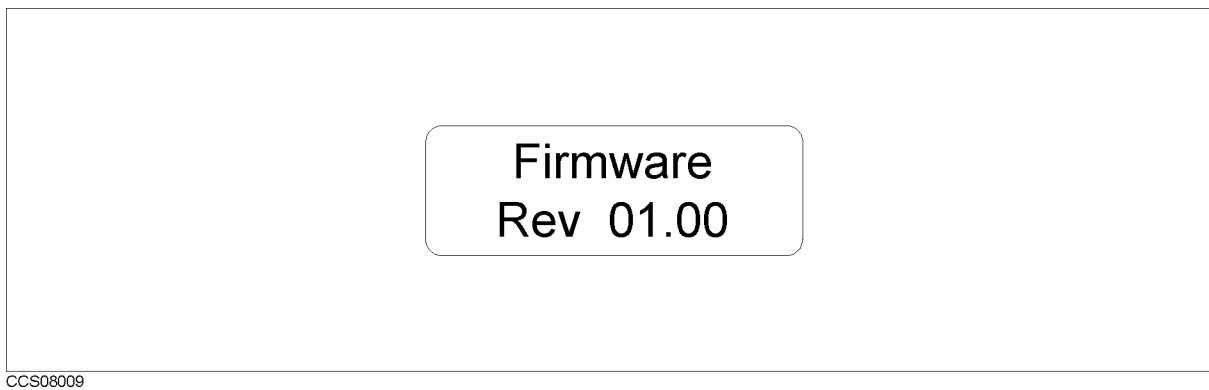
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## FIRMWARE INSTALLATION

No firmware is installed in new A1 CPU assembly. When you replace a faulty A1 CPU with a new one, perform the following steps to install the firmware into the A1 CPU.

### Ordering the Firmware Diskette

A firmware diskette (3.5 inch) that contains the analyzer's firmware is required for the firmware installation. If you do not have a firmware diskette, you must order one. For ordering information, contact your nearest Agilent Technologies service center and provide the revision of the analyzer's firmware. The part number of the firmware diskette depends on the firmware revision. The firmware revision of the analyzer is indicated on the revision label attached on the rear panel as shown in Figure 8-3.

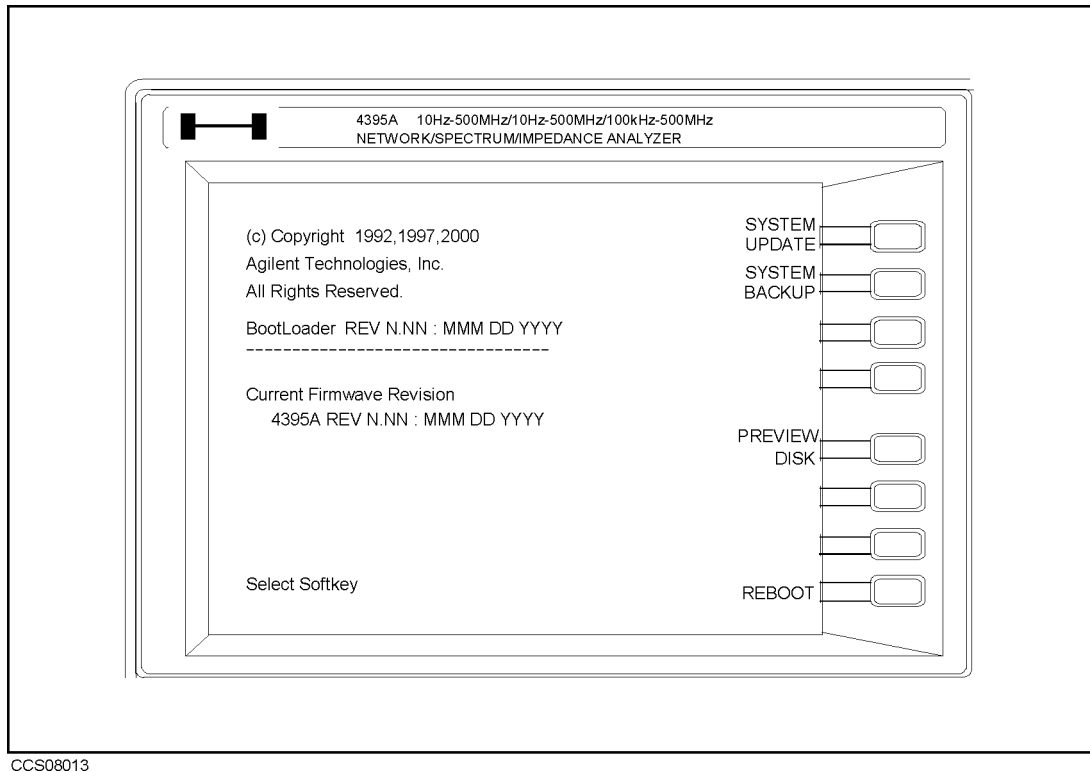


**Figure 8-3. Firmware Revision Label**

### Installing the Firmware

Perform the following procedure to install the firmware into the analyzer.

1. Turn the analyzer power off.
2. Press both the **Start** and **Preset** keys. While pressing both keys, turn the analyzer power on.
3. Wait until the bootloader menu appears on the LCD as shown in Figure 8-4.



**Figure 8-4. Bootloader Menu Display**

4. Insert the firmware diskette into the floppy disk drive on the front panel.
5. Press **SYSTEM UPDATE** and **CONTINUE**. The analyzer displays “Loading From Disk” and starts the firmware installation.
6. Wait until the analyzer displays “Update Complete.”
7. Press **REBOOT** or turn the analyzer power off and on. The analyzer starts the operation using the installed firmware.
8. Verify that no error message is displayed and that the revision displayed is that of the revision label.
  - In case of unexpected results, inspect the firmware diskette for any damage. Clean the built-in FDD and retry the procedure.

---

## START HERE

### 1. Check the Power-On Sequence

See the INSPECT THE POWER-ON SEQUENCE in the chapter 6 for checking the Power-On Sequence.

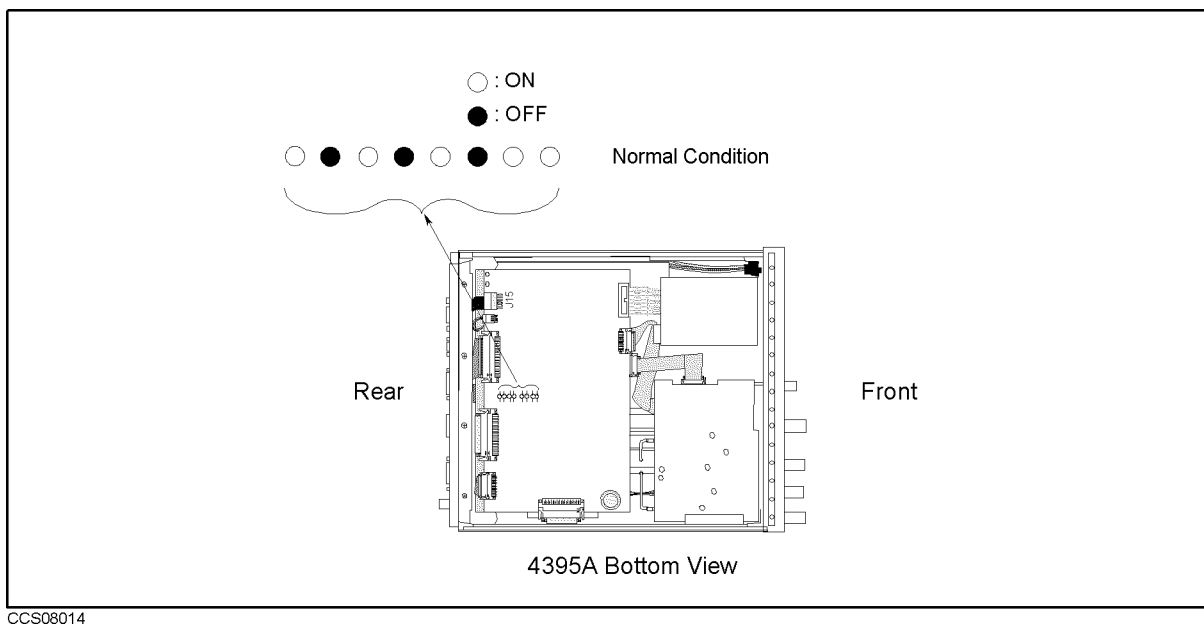
#### Check the **Ch 1** and **Ch 2** Operations

- a. Press **Ch 1** and **Ch 2** alternately.
- b. Check that the two LEDs alternately light each time you press the keys.
  - If both LEDs would not light, continue with the next *Check the A1 Eight LEDs*.
  - If the two LEDs do not alternately light (the **Ch 1** LED is still lit even if pressing the **Ch 2**), the A1 CPU is probably faulty. Replace the A1 CPU.
  - If the two LEDs alternately light each time you press the keys, the A1 CPU is probably working properly. Continue with the *TROUBLESHOOT THE A51 GSP AND A52 LCD* in this chapter.

#### Check the A1 Eight LEDs

There are eight LEDs on the A1 CPU. These LEDs should be in the pattern shown in Figure 8-5 at the end of the power on sequence. Perform the following procedure to check the A1 eight LEDs.

- a. Turn the analyzer turn off.
- b. Remove the bottom cover of the analyzer.
- c. Turn the analyzer power on.
- d. Look at the A1 eight LEDs. Some of the LEDs light during the power on sequence. At the end of the power on sequence, the LEDs should stay in the pattern shown in Figure 8-5. If the LEDs stay in the other pattern, the A1 CPU is probably faulty. Replace the A1 CPU.



**Figure 8-5. A1 Eight LEDs' Pattern**

## 2. Check Error Messages

Turn the analyzer power on. Check no error message appears on the LCD.

- If no error message is displayed, continue with the *Check A1 DRAM and Flash Memory* in this *START HERE*.
- If one of error messages listed below is displayed, follow the instruction described below. For the other message, see the *Error Messages* in Messages.

### Error Messages

### Instruction

POWER ON TEST FAILED

This indicates the power on selftest failed. Continue with the next *Check Power On Selftest* in the chapter 6.

EEPROM CHECK SUM ERROR

This indicates that the correction constants stored in the EEPROM on the A1 CPU are invalid or the EEPROM is faulty. Rewrite all correction constants into the EEPROM. For the detailed procedure, See the *Adjustments* chapter in this manual. If the rewriting is not successfully performed, replace the EEPROM and then rewrite the all correction constants into the new EEPROM.

Svc (Status Annotation)

This indicates that the correction constants stored in the EEPROM on the A1 CPU are invalid or the EEPROM is faulty. See the instruction of the **EEPROM CHECK SUM ERROR** message.

POWER FAILED ON - - -

One or some of A2 power supplies, +15 V, +8.5 V, +5.3 V, +5 V, -5 V, -15 V are displayed in - - - of the message. The displayed power supplies are shut down due to the trouble on the A2 post-regulator. Continue with the *Power Supply Troubleshooting* chapter.

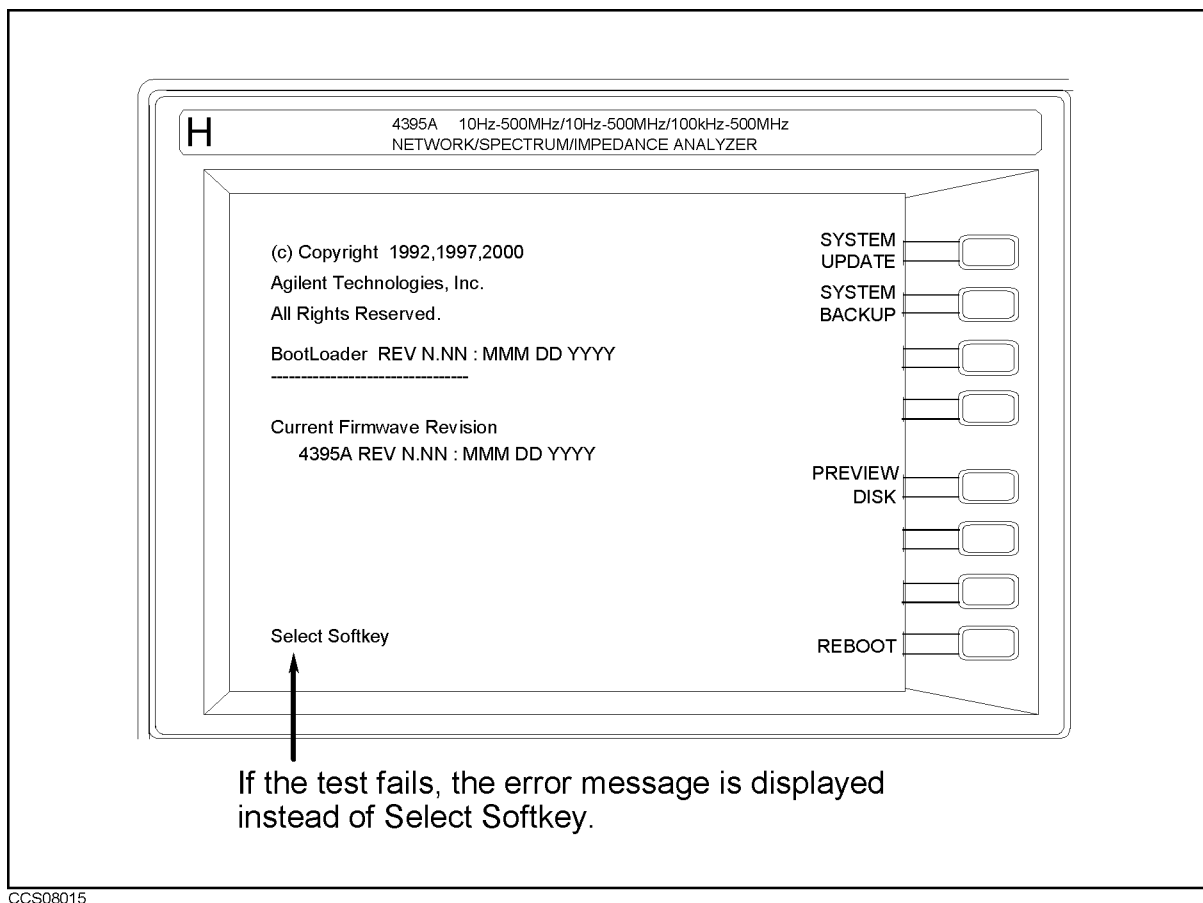
|                            |                                                                                                                                                                                                                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| POWER FAILED ON PostRegHot | This indicates A2 power supplies, +15 V, +8.5 V, +5.3 V, +5 V, -5 V, -15 V, are shut down due to too hot heat sink on A2 post-regulator. Cool down the analyzer for about 30 minutes. Then turn the analyzer power on. If this message is still displayed, replace A2 post-regulator. |
| PHASE LOCK LOOP UNLOCKED   | This indicates one or some of PLLs (phase lock loops) in the oscillators is not working properly. These oscillators are checked in the internal test 0: ALL INT. Continue with the next <i>Check the Power On Selftest</i> in where the ALL INT test is executed.                     |

### 3. Check the A1 DRAM and Flash Memory

The A1 DRAM and flash memory are tested on the sequence to access the bootloader menu.

Perform the following procedure to verify the A1 DRAM and flash memory.

- a. Turn the analyzer power off.
- b. Push two keys **Start** and **Preset**. With keeping the two keys pushed down, turn the analyzer power on.
- c. Wait for the display shown in Figure 8-6 appears on the LCD.
- d. Check no error message displayed on the LCD.
  - If no error message is displayed, the A1 DRAM and flash memories are verified. Continue with the next *Check the A1 Volatile Memory*.
  - If an error message is displayed or the display shown in Figure 8-6 does not appear, the A1 CPU is probably faulty. Replace the A1 CPU.



**Figure 8-6. Bootloader Display**

#### 4. Check the A1 Volatile Memory

- Turn the analyzer power on.
- Press **(System)**, **SERVICE MENU**, **TESTS**, **(2)**, **(x1)**, **EXECUTE TEST** to run the internal test 2: A1 VOLATILE MEMORY.
- Check no error message displayed. At the end of this test, the analyzer returns the control settings to the default values (power on reset). If the test fails, the analyzer displays an error messages for a few second before returning to the defaults.
  - If no error message is displayed, the A1 volatile memories are verified. Continue with the next *Check the A30 Front Keyboard*.
  - If one of error messages listed below is displayed, the A1 CPU is faulty. Replace the A1 CPU.
    - CPU INTERNAL SRAM R/W ERROR
    - DSP SRAM R/W ERROR
    - DUAL PORT SRAM R/W ERROR
    - CPU BACKUP SRAM R/W ERROR

## 5. Check the A30 Front Keyboard

The A30 front keyboard can be checked using the external test 50: FRONT PANEL DIAG.

- a. Press **PRESET**, **SYSTEM**, **SERVICE MENU**, **TESTS**, **5**, **0**, **x1**, **EXECUTE TEST** to run the external test 17.
- b. Press all of the front panel keys. The pressed abbreviated key name should be displayed at a key pressed. When you rotate the RPG knob, the RPG tuned direction (CW or CCW) and its response speed (SLOW, MID, FAST) should be displayed. So you can check every key on the A30 Keyboard except for **PRESET**. (If you want to exit this test, press **PRESET**.)
  - If one or more keys seems to be defective, replace the A30 front keyboard.
  - If all keys seem to be good, the A30 front keyboard is verified. Continue with the next *Check the A53 FDD*.

## 6. Check the A53 FDD

The A53 FDD (Flexible Disk Drive) can be checked using the external test 51: DSK DR FALUT ISOL'N.

- a. Press **PRESET**, **SYSTEM**, **SERVICE MENU**, **TESTS**, **5**, **1**, **x1**, **EXECUTE TEST** to run the external test 51.
- b. As the analyzer instructs, insert a flexible disk into FDD. Use a formatted but blank flexible disk, otherwise the data on the disk will be overwritten by this test. Then press **CONT**.
- c. Check the test result, PASS or FAIL, that is displayed at the end of the test.
  - If this test fails, replace the A53 FDD.

## 7. Check the A32 I-BASIC Interface and the mini DIN Keyboard

The mini DIN external keyboard is connected to the A32 I-BASIC I/O connector, and is used to develop programs.

If the external keyboard of the I-Basic is not working, perform the following procedure to verify the keyboard.

Press **PRESET**, **SYSTEM**, **SERVICE MENU**, **TESTS**, **1**, **x1**, **EXECUTE TEST** to run the internal test 1: A1 CPU.

- If the internal test 1 passes, the Agilent driver circuit on the A1 CPU is probably working. Inspect cables between the external keyboard and the A1 CPU through the A32 I-BASIC interface. If the cable is good, replace the external keyboard.
- If the internal test 1 fails, replace the A1 CPU.



## 8. Check the A33 EXT I/O Interface

The A33 EXT I/O interface is used to control the external instrument like the printer/scanner/handler.

If the external instrument is not working, perform the following procedure to verify the EXT I/O interface.

Press **PRESET**, **SYSTEM**, **SERVICE MENU**, **TESTS**, **5**, **2**, **x1**, **EXECUTE TEST** to run the internal test 52: 24 BIT I/O PORT.

- If the internal test 52 passes, the A33 EXT I/O interface board is probably working. Inspect cables between the A1 CPU and the A33 EXT I/O interface. If the cable is good, check the external instrument.
- If the internal test 52 fails, replace the A33 EXT I/O interface board.

---

## TROUBLESHOOT THE A51 GSP and A52 LCD

Use this procedure when the LCD(Liquid Crystal Display) is unacceptable, or not being bright.

### 1. Run the Internal Test 3: A51 GSP.

The A51 GSP can be checked using the internal test 3: A51 GSP, if the test fails, the (Ch 1) and (Ch 2) LEDs blink several time and a few beeps sound at the end of the test. Then the analyzer returns the control settings to the power-on default setting values.

- a. Press (PRESET), (SYSTEM), SERVICE MENU, TESTS, (3), (x1), EXECUTE TEST to run the internal test 3. When this test starts, (Ch 1) LED and (Ch 2) LED are turned off.
- b. Check the (Ch 1) and (Ch 2) LEDs and the beeps at the end of the test.
  - If no beep sound and the LEDs don't blink, the A51 GSP is probably working. Continue with the next *Check the Two LEDs on A51 GSP*.
  - If a beep sounds and the LEDs blink one time, the A51 GSP chip is faulty. Replace the A51 GSP.
  - If two beep sound and the LED blinks two time, the A51 GSP's DRAM is faulty. Replace the A51 GSP.
  - If three beep sound and the LED blinks three time, the A51 GSP's VRAM is faulty. Replace the A51 GSP.

### 2. Check the A52 LCD(Liquid Crystal Display)

The A52 LCD can be tested using the internal test 70 to 74.

- a. Press (PRESET), (SYSTEM), SERVICE MENU, TESTS, (7), (0), (x1), EXECUTE TEST CONTINUE to run the internal test 70, and run the other tests with the same manner.
- b. If any defects on the LCD, replace the LCD.
- c. If no correct patterns are displayed, check the A54 Inverter.

## Accessories Troubleshooting

---

### INTRODUCTION

Use these procedures only if you have followed the troubleshooting procedures and believe the problem is one of the accessories. Reconfigure the system as it is normally used and reconfirm the measurement problem. The measurement problem must be caused by a failure outside of the analyzer (that is, by one of the accessories).

Suspect the following typical problems:

- Operation Errors (for example, too high an input level in the spectrum measurement or improper calibration techniques in the network measurement).
- Faulty Accessories (for example, damaged adapters and RF cables in the spectrum and network measurements, a faulty power splitter, T/R test set, or S-Parameter Test Set in the network measurement).

This chapter consists of the following procedures. Perform these procedures sequentially.

*VERIFY OPERATIONS*

*INSPECT CONNECTORS*

*INSPECT ACCESSORIES*

---

## VERIFY OPERATIONS

The measurement problem can be caused by improper operation. Confirm that all operations, connections and control settings, etc., are properly made during the measurement. For detailed information about proper operations, see the following manuals:

*Operation Manual* (p/n 04395-90000)

*Programming Manual* (p/n 04395-90000)

Some examples of the typical operation errors are shown in the following paragraph.

### Using 75 $\Omega$ Connectors with 50 $\Omega$ Connectors

Do not use 50  $\Omega$  connectors with 75  $\Omega$  connectors; their center conductors are different diameters. Using a 50  $\Omega$  male connector with a 75  $\Omega$  female connector will destroy the female connector.

### Large Spurious Signals in the Spectrum Measurement

Large spurious signals around the fundamental signal can be caused by an input signal level that is higher than the reference level. Reducing the input signal level or setting the reference level higher can solve the spurious signal problem.

### Odd Appearing Opens and Shorts in the Network Measurement

Opens and shorts can appear as short lines (rather than the expected points) on a Smith Chart. This is a result of some shorts and opens being offset. See the calibration kit manual to determine the offset. To verify the opens and shorts, see *Verify Shorts and Opens* in the *Inspect the Calibration Kit* procedure later in this chapter.

---

## INSPECT THE CONNECTORS

Check the physical condition of the analyzer front-panel connectors, the calibration kit devices, and the test set connectors.

1. Inspect the front panel connectors on the analyzer. Check for bent or broken center pins and loose connector bulkheads.

Gage the connectors. (Gage kit is Agilent part number 85054-80011.) The specified front-panel type-N connector center pin **protrusion** is 0.201 to 0.207 inch.

If the center pin protrusion is incorrect, replace the entire connector assembly or A9 input multiplexer. See the *Replaceable Parts* chapter.

2. Inspect the calibration kit devices for bent or broken center conductors and other physical damage. Gage each device. The mechanical specifications for each device are given in the calibration kit manual.

If any calibration device is out of mechanical tolerance, replace the device.

3. Inspect and the gage test set and the power splitter connectors as described in steps 1 and 2.

---

## INSPECT THE ACCESSORIES

Measurement problems can be caused by faulty accessories or faulty devices between the accessories and the analyzer. For example, the RF cables, the probe power connector, the TEST SET-I/O INTERCONNECT connector, and the interconnect cable can cause problems.

Some recommended accessories used with the analyzer are listed below.

- Test Sets (for example, the 85046A/B S Parameter Test Set).
- Active Probes (for example, the 41800A Active Probe).
- Preamplifier (for example, the 19855A Broadband Preamplifier).
- Power Splitter and Directional Bridges (for example, the 11850C/D Three-way Power Splitter).
- Calibration Kits (for example, the 85032B 50  $\Omega$  Type-N Calibration Kit).

Inspect the cables for any damage. Verify the probe power connector and the TEST SET-I/O INTERCONNECT connector (if they are used). Then inspect and verify the accessories that are used in the measurement.

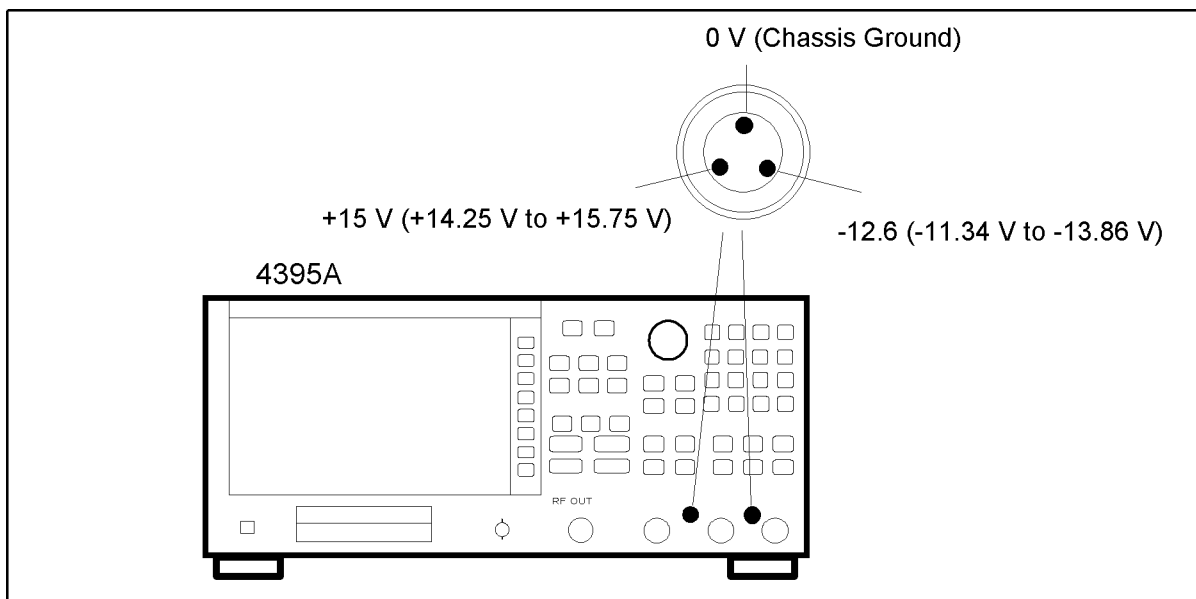
This inspection consists of the following procedures:

*Verify the Probe Power*  
*Inspect the Test Set*  
*Inspect the Calibration Kit*

### Verify the Probe Power

Perform the following procedure to verify the front-panel probe power connector:

1. Turn the analyzer power off.
2. Remove the power cable of the accessory from the probe power connector.
3. Turn the analyzer power on.
4. Measure the power voltages (+15 V and -12.6 V) at the probe power connector using a voltmeter with a small probe. See Figure 9-1 for the voltages and pins on the probe power connector.
  - If the voltages are within the limits, the analyzer's probe power is verified. Suspect a faulty accessory. Verify the accessory used in the measurement problem in accordance with its manual.
  - If the voltages are out of the limits, see the *Power Supply Troubleshooting* chapter in this manual to troubleshoot the power lines (+15 V(AUX) and -12.6 V) of the probe power.



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**Figure 9-1. Probe Power Connector Voltages**

## Inspect the Test Set

This procedure checks the operation of the RF transfer switch in the 85046A/B test set.

1. Turn the analyzer power off.
2. Connect the test set to the analyzer.
3. Turn the analyzer power on.
4. Press **PRESET**, **Meas**, **ANALYZER TYPE**, **NETWORK ANALYZER**, **Ref1: REV S22(B/R)**. Then check that the S22 S12 indicator LED lits.
5. Press **Ref1: FWD S11 (A/R)**. Check that the S11 S21 indicator LED lits.
  - If the LED operations are not expected, inspect the cable between the analyzer and the test set. If the cable seems good, verify the test set in accordance with its manual.
  - If the LED operations are correct, continue with this chapter unless a test set failure is suspected. To troubleshoot test set failures, see the test set manual.

## Inspect the Calibration Kit

Inspect all of the terminations (load, open, and short) for any damage. If no damage is found, perform the following procedure to verify the short and open. If any damage is found, replace the termination with a good one.

## Verify Shorts and Opens

Substitute a known good short and open of the same connector type as the terminations in question. If the devices are not from a standard calibration kit, see *Modifying Calibration Kits* in the *Function Reference* to use the **MODIFY [CAL KIT]** function. Set aside the short and open that could be causing the problem.

1. Perform an S11 1-port calibration on a port using the good short and open. Then press **Format**, **SMITH CHART** to view the devices in Smith chart format.
2. Connect the good short to the calibrated port. Press **Scale Ref**, **ELEC DELAY MENU**, **ELECTRICAL DELAY** and turn the RPG to enter enough electrical delay so that the trace appears as a dot at the left side of the circle.

Replace the good short with the questionable short at the port. The trace of the questionable short should appear very similar to the known good short.

3. Connect the good open to the calibrated port. Press **Scale Ref**, **ELEC DELAY MENU**, **ELECTRICAL DELAY** and turn the RPG to enter enough electrical delay so that the trace appears as a dot at the right side of the circle.

Replace the good open with the questionable open at the port. The trace of the questionable open should appear very similar to the known good open.



## Replaceable Parts

---

### Introduction

This chapter lists the analyzer's replaceable parts. How to order the parts is also described.

---

### Ordering Information

To order a part listed in the replaceable parts table, quote the Agilent Technologies part number (with a check digit), indicate the quantity required, and address the order to the nearest Agilent Technologies office. The check digit will ensure accurate and timely processing of the order.

To order a part not listed in the replaceable parts table, include the instrument model number, the description and function of the part, and the quantity of parts required. Address the order to the nearest Agilent Technologies office.

### Direct Mail Order System

Within the USA, Agilent Technologies can supply parts through a direct mail order system. Advantages of using this system are:

1. Direct ordering and shipment from the Agilent Technologies Parts Center in Mountain View, California.
2. No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local Agilent Technologies office when the orders require billing and invoicing).
3. Prepaid transportation (there is a small handling charge for each order).
4. No invoices.

To provide these advantages, a check or money order must accompany each order.

Mail order forms and specific ordering information are available through your local Agilent Technologies office, addresses and phone numbers are located at the back of this manual.

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## Exchange Assemblies

Under the rebuilt-exchange assembly program, certain factory-repaired and tested assemblies are available on a trade-in basis. These assemblies are offered at lower cost than a new assembly while meeting all of the factory specifications required of a new assembly.

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## Replaceable Parts List

Replaceable parts tables list the following information for each part.

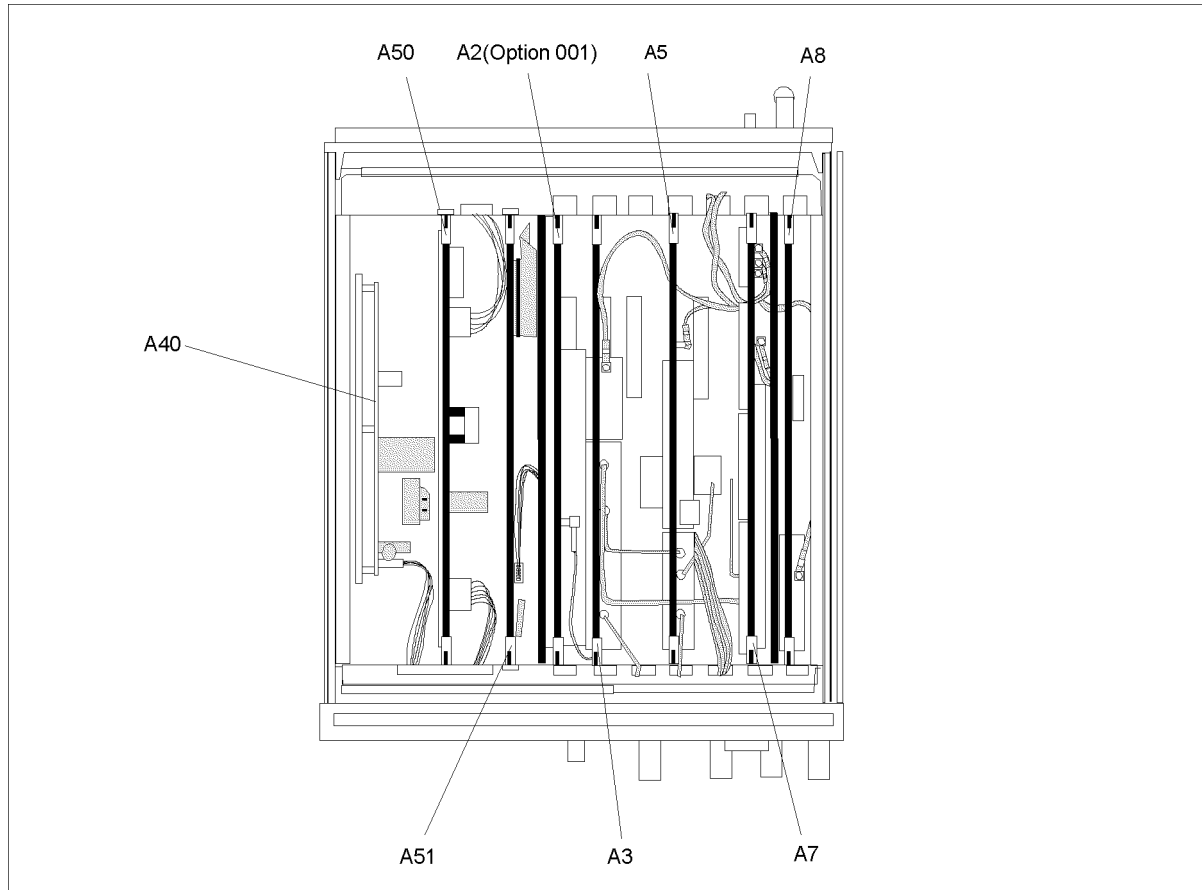
- 1 Agilent Technologies part number.
- 2 Part number check digit (CD).
- 3 Part quantity as shown in the corresponding figure. There may or may not be more of the same part located elsewhere in the instrument.
- 4 Part description, using abbreviations (see Table 10-2).
- 5 A typical manufacturer of the part in a five-digit code (see Table 10-1).
- 6 The manufacturer's part number.

**Table 10-1. Manufacturers Code List**

| Mfr # | Name                                 | Location            | Zipcode |
|-------|--------------------------------------|---------------------|---------|
| 00779 | AMP INC                              | HARRISBURG PA US    | 17111   |
| 06369 | HIROSE ELECTRIC CO                   | JP                  |         |
| 06691 | HOUSE OF METRICS LTD                 | SPRING VALLEY NY US | 10977   |
| 08747 | KITAGAWA KOGYO                       | TOKYO JP            |         |
| 09635 | TAJIMI MUSEN                         | TOKYO JP            |         |
| 10572 | XICOR INC                            | MILPITAS CA         |         |
| 12085 | SCHLEGEL CORP                        | ROCHESTER NY US     | 14692   |
| 13160 | TEAC OF AMERICA INC                  | MONTEBELLO CA US    | 90640   |
| 28480 | AGILENT TECHNOLOGIES CO CORPORATE HQ | PALO ALTO CA US     | 94304   |
| 28520 | HEYCO MOLDED PRODUCTS                | KENTWORTH NJ US     | 07033   |
| 73734 | FEDERAL SCREW PRODUCTS CO            | CHICAGO IL US       | 60618   |
| 76381 | 3M CO                                | ST PAUL MN US       | 55144   |
| 78189 | ILLINOIS TOOL WORKS INC SHAKEPROOF   | ELGIN IL US         | 60126   |

**Table 10-2. List of Abbreviations**

|         |                               |         |                                                         |
|---------|-------------------------------|---------|---------------------------------------------------------|
| A       | : amperes                     | N/C     | : normally closed                                       |
| A.F.C.  | : automatic frequency control | NE      | : neon                                                  |
| AMPL    | : amplifier                   | NI PL   | : nickel plate                                          |
| B.F.O   | : beat frequency oscillator   | N/O     | : normally open                                         |
| BE CU   | : beryllium copper            | NPO     | : negative positive zero (zero temperature coefficient) |
| BH      | : binder head                 | NPN     | : negative-positive-negative                            |
| BP      | : bandpass                    | NRFR    | : not recommended for field replacement                 |
| BRS     | : brass                       | NSR     | : not separately replaceable                            |
| BWO     | : backward wave oscillator    | OBD     | : order by description                                  |
| CCW     | : counter-clockwise           | OH      | : oval head                                             |
| CER     | : ceramic                     | OX      | : oxide                                                 |
| CMO     | : cabinet mount only          | P       | : peak                                                  |
| COEF    | : coefficient                 | PC      | : printed circuit                                       |
| COM     | : common                      | p       | : pico                                                  |
| COMP    | : composition                 | PH BRZ  | : phosphor bronze                                       |
| COMPL   | : complete                    | PHL     | : Philips                                               |
| CONN    | : connector                   | PIV     | : peak inverse voltage                                  |
| CP      | : cadmium plate               | PNP     | : positive-negative-positive                            |
| CRT     | : cathode-ray tube            | P/O     | : part of                                               |
| CW      | : clockwise                   | POLY    | : polystyrene                                           |
| DE PC   | : deposited carbon            | PORC    | : porcelain                                             |
| DR      | : drive                       | POS     | : position(s)                                           |
| ELECT   | : electrolytic                | POT     | : potentiometer                                         |
| ENCAP   | : encapsulated                | PP      | : peak to peak                                          |
| EXT     | : external                    | PT      | : point                                                 |
| F       | : farads                      | PWV     | : peak working voltage                                  |
| f       | : femto                       | RECT    | : rectifier                                             |
| FH      | : flat head                   | RF      | : radio frequency                                       |
| FIL H   | : fillister head              | RH      | : round head or right hand                              |
| FXD     | : fixed                       | RMO     | : rack mount only                                       |
| G       | : giga                        | RMS     | : root-mean square                                      |
| GE      | : germanium                   | RWV     | : reverse working voltage                               |
| GL      | : glass                       | S-B     | : slow-blow                                             |
| GRD     | : ground(ed)                  | SCR     | : screw                                                 |
| H       | : henries                     | SE      | : selenium                                              |
| HEX     | : hexagonal                   | SECT    | : section(s)                                            |
| HG      | : mercury                     | SEMICON | : semiconductor                                         |
| HR      | : hour(s)                     | SI      | : silicon                                               |
| Hz      | : hertz                       | SIL     | : silver                                                |
| IF      | : intermediate freq.          | SL      | : slide                                                 |
| IMPG    | : impregnated                 | SPG     | : spring                                                |
| INCD    | : incandescent                | SPL     | : special                                               |
| INCL    | : include(s)                  | SST     | : stainless steel                                       |
| INS     | : insulation(ed)              | SR      | : split ring                                            |
| INT     | : internal                    | STL     | : steel                                                 |
| k       | : kilo                        | TA      | : tantalum                                              |
| LH      | : left hand                   | TD      | : time delay                                            |
| LIN     | : linear taper                | TGL     | : toggle                                                |
| LK WASH | : lock washer                 | THD     | : thread                                                |
| LOG     | : logarithmic taper           | TI      | : titanium                                              |
| LPF     | : low pass filter             | TOL     | : tolerance                                             |
| m       | : milli                       | TRIM    | : trimmer                                               |
| M       | : meg                         | TWT     | : traveling wave tube                                   |
| MET FLM | : metal film                  | $\mu$   | : micro                                                 |
| MET OX  | : metallic oxide              | VAR     | : variable                                              |
| MFR     | : manufacturer                | VDCW    | : dc working volts                                      |
| MINAT   | : miniature                   | W/      | : with                                                  |
| MOM     | : momentary                   | W       | : watts                                                 |
| MTG     | : mounting                    | WIV     | : working inverse voltage                               |
| MY      | : "mylar"                     | WW      | : wirewound                                             |
| n       | : nano                        | W/O     | : without                                               |



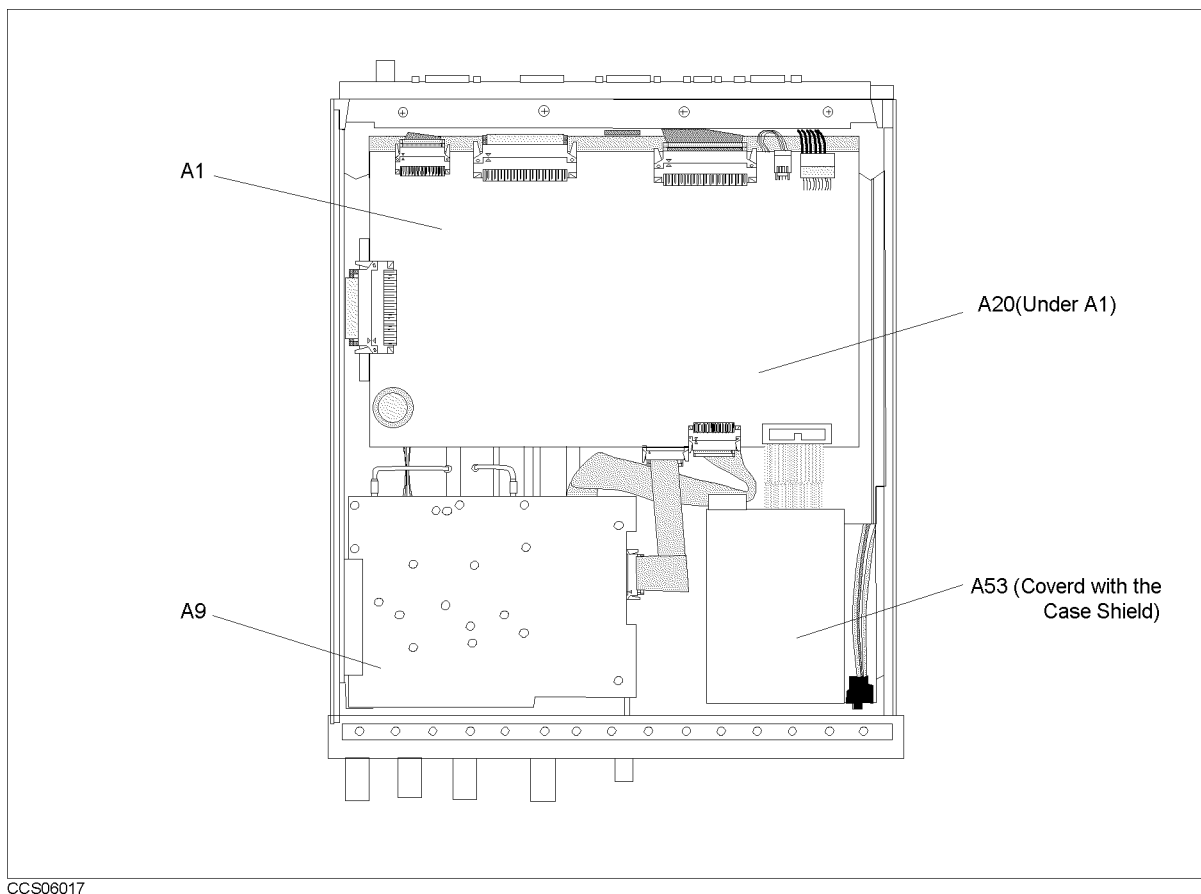
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**Figure 10-1. Top View (Major Assemblies)**

#### **10-4 Replaceable Parts**

**Table 10-3. Top View (Major Assemblies)**

| <b>Ref.<br/>Desig.</b> | <b>Agilent Part<br/>Number</b> | <b>C<br/>D</b> | <b>Qty.</b> | <b>Description</b>                      | <b>Mfr<br/>Code</b> | <b>Mfr Part<br/>Number</b> |
|------------------------|--------------------------------|----------------|-------------|-----------------------------------------|---------------------|----------------------------|
| A2                     | E4970-66502                    | 9              | 1           | DC BIAS (Opt. 001)                      | 28480               | E4970-66502                |
| A3                     | E4970-66503                    | 0              | 1           | TRACKING SOURCE                         | 28480               | E4970-66503                |
|                        | E4970-69503                    |                | 1           | TRACKING SOURCE<br>(rebuilt-exchange)   | 28480               | E4970-69503                |
| A5                     | E4970-66515                    | 4              | 1           | LOCAL SYNTHESIZER                       | 28480               | E4970-66515                |
|                        | E4970-69515                    |                |             | LOCAL SYNTHESIZER<br>(rebuilt-exchange) | 28480               | E4970-69515                |
| A7                     | E4970-66507                    | 4              | 1           | FREQ. CONVERTER                         | 28480               | E4970-66507                |
|                        | E4970-69507                    |                |             | FREQ. CONVERTER<br>(rebuilt-exchange)   | 28480               | E4970-69507                |
| A8                     | E4970-66508                    | 5              | 1           | DIGITAL IF                              | 28480               | E4970-66508                |
|                        | E4970-69508                    |                |             | DIGITAL IF<br>(rebuilt-exchange)        | 28480               | E4970-69508                |
| A40                    | 0950-3246                      | 7              | 1           | PRE-REGULATOR                           | 28480               | 0950-3246                  |
| A50                    | E4970-66550                    | 7              | 1           | DC-DC CONVERTER                         | 28480               | E4970-66550                |
| A51                    | E4970-66551                    | 8              | 1           | GSP                                     | 28480               | E4970-66551                |



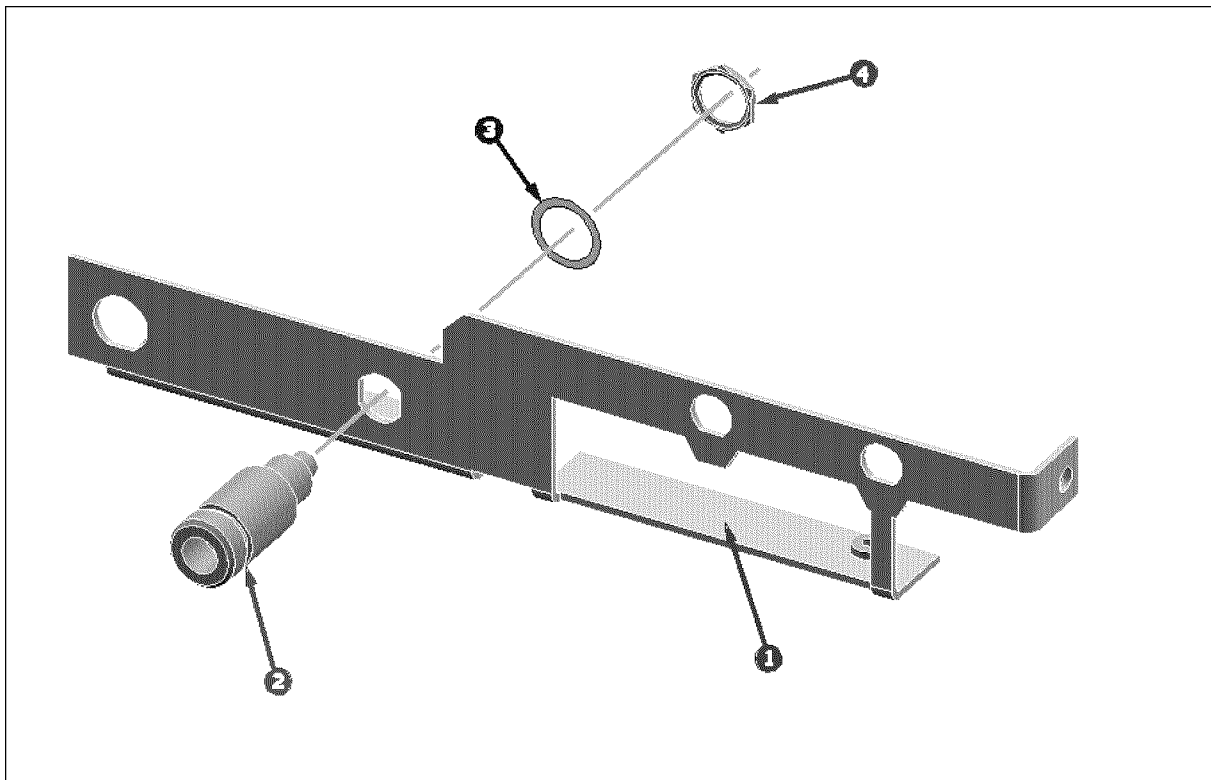
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**Figure 10-2. Bottom View (Major Assemblies)**

**Table 10-4. Bottom View (Major Assemblies)**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description                             | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-----------------------------------------|----------|-----------------|
| A1          | E4970-66501         | 8   | 1    | CPU Board                               | 28480    | E4970-66501     |
| A9          | E4970-66509         | 6   | 1    | INPUT MULTIPLEXER                       | 28480    | E4970-66509     |
|             | E4970-69509         |     |      | INPUT MULTIPLEXER<br>(rebuilt-exchange) | 28480    | E4970-69509     |
| A20         | E4970-66520         | 1   | 1    | MOTHER BOARD                            | 28480    | E4970-66520     |
| A53         | 0950-3334           | 1   | 1    | FDD                                     | 28480    | 0950-3334       |

## 10-6 Replaceable Parts

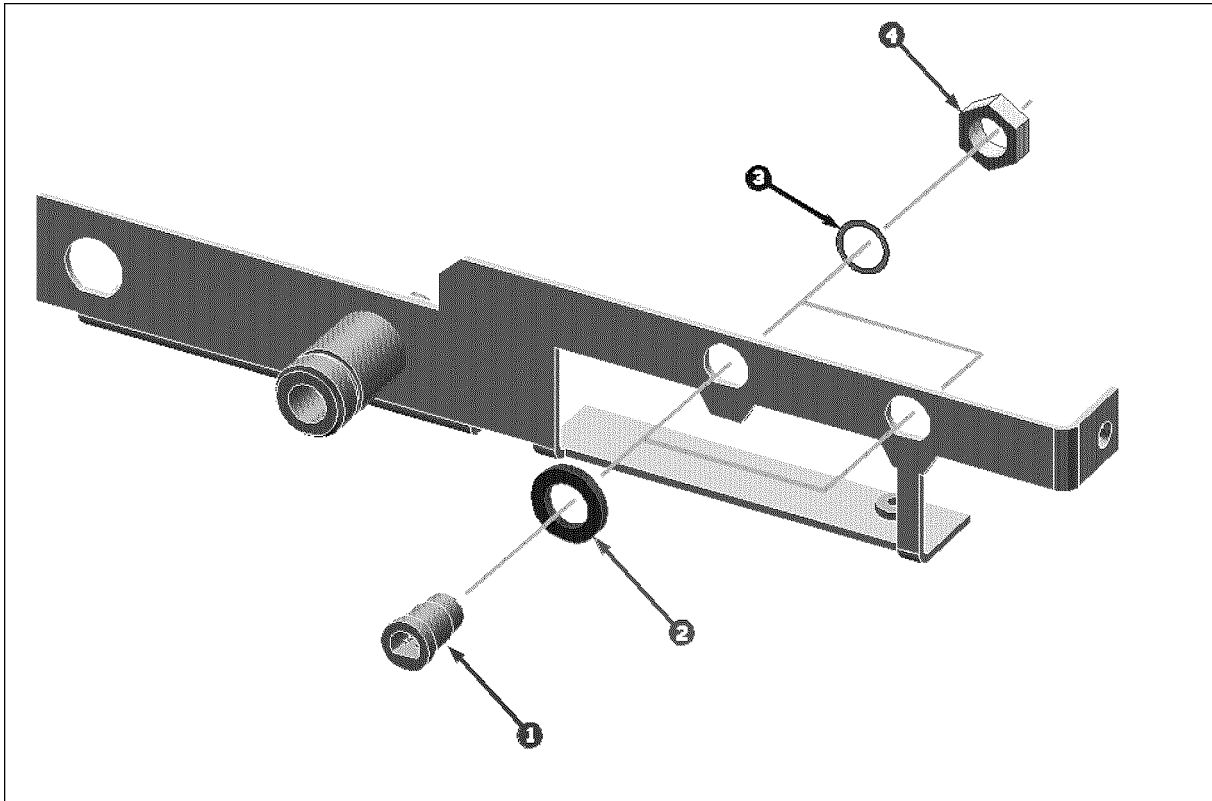


CCS06018

**Figure 10-3. Angle Assembly Parts 1/5**

**Table 10-5. Angle Assembly Parts 1/5**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description      | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|------------------|-------------|--------------------|
| 1              | E4970-01203            | 1      | 1    | ANGLE B          | 28480       | E4970-01203        |
| 2              | 1250-2312              | 3      | 1    | ADPT-RF N-SMA    | 28480       | 1250-2312          |
| 3              | 2190-0104              | 0      | 1    | WSHR-LK INTL T   | 28480       | 2190-0104          |
| 4              | 2950-0132              | 6      | 1    | NUT-HEX-DUB-CHAM | 28480       | 2950-0132          |



CCS06019

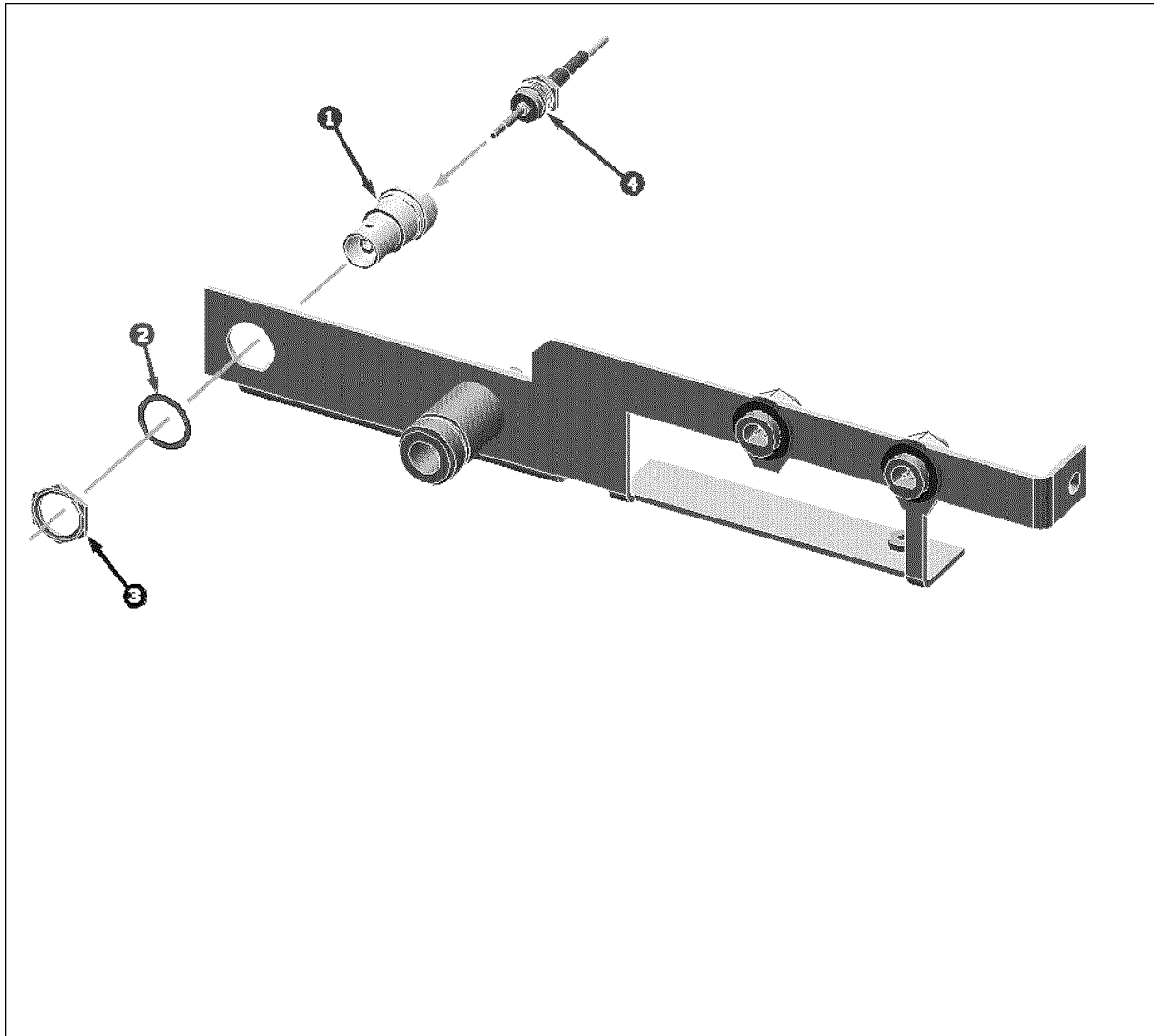
**Figure 10-4. Angle Assembly Parts 2/5**

**Table 10-6. Angle Assembly Parts 2/5**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description      | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|------------------|----------|-----------------|
| 1           | 1252-4294           | 8   | 2    | CONN CIR 3M GRY  | 28480    | 1252-4294       |
| 2           | 04396-25003         | 6   | 2    | SPACER           | 28480    | 04396-25003     |
| 3           | 2190-0016           | 3   | 2    | WSHR-LK INTL T   | 28480    | 2190-0016       |
| 4           | 2950-0144           | 0   | 2    | NUT-HEX-DBL-CHAM | 28480    | 2950-0144       |

## 10-8 Replaceable Parts



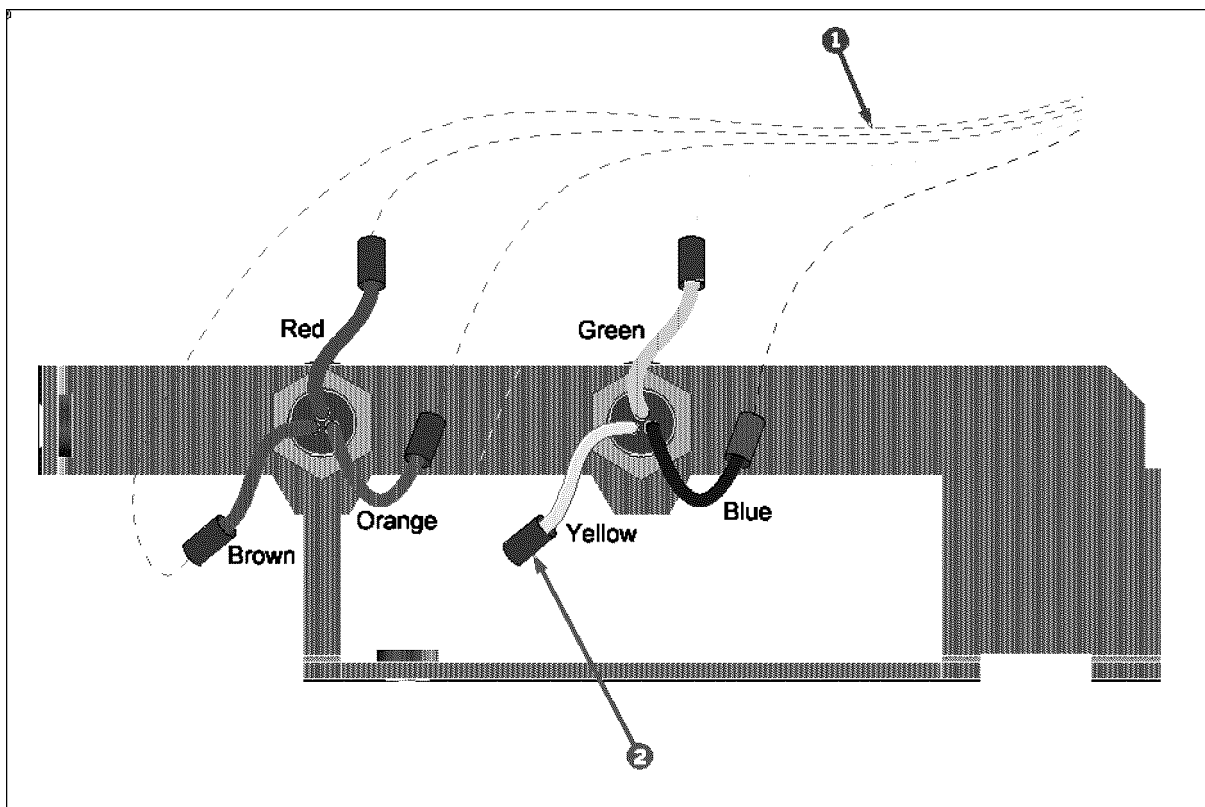


CCS06020

**Figure 10-5. Angle Assembly Parts (Opt. 001) 3/5**

**Table 10-7. Angle Assembly Parts (Opt. 001) 3/5**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description             | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-------------------------|----------|-----------------|
| 1           | 1250-0252           | 6   | 1    | CONN-RF BNC             | 28480    | 1250-0252       |
| 2           | 2190-0102           | 8   | 1    | WSHR-LK INTL T          | 28480    | 2190-0102       |
| 3           | 2950-0035           | 8   | 1    | NUT-HEX-DBL-CHAM        | 28480    | 2950-0035       |
| 4           | 04396-61631         | 2   | 1    | RF CABL ASSY (Opt. 001) | 28480    | 04396-61631     |

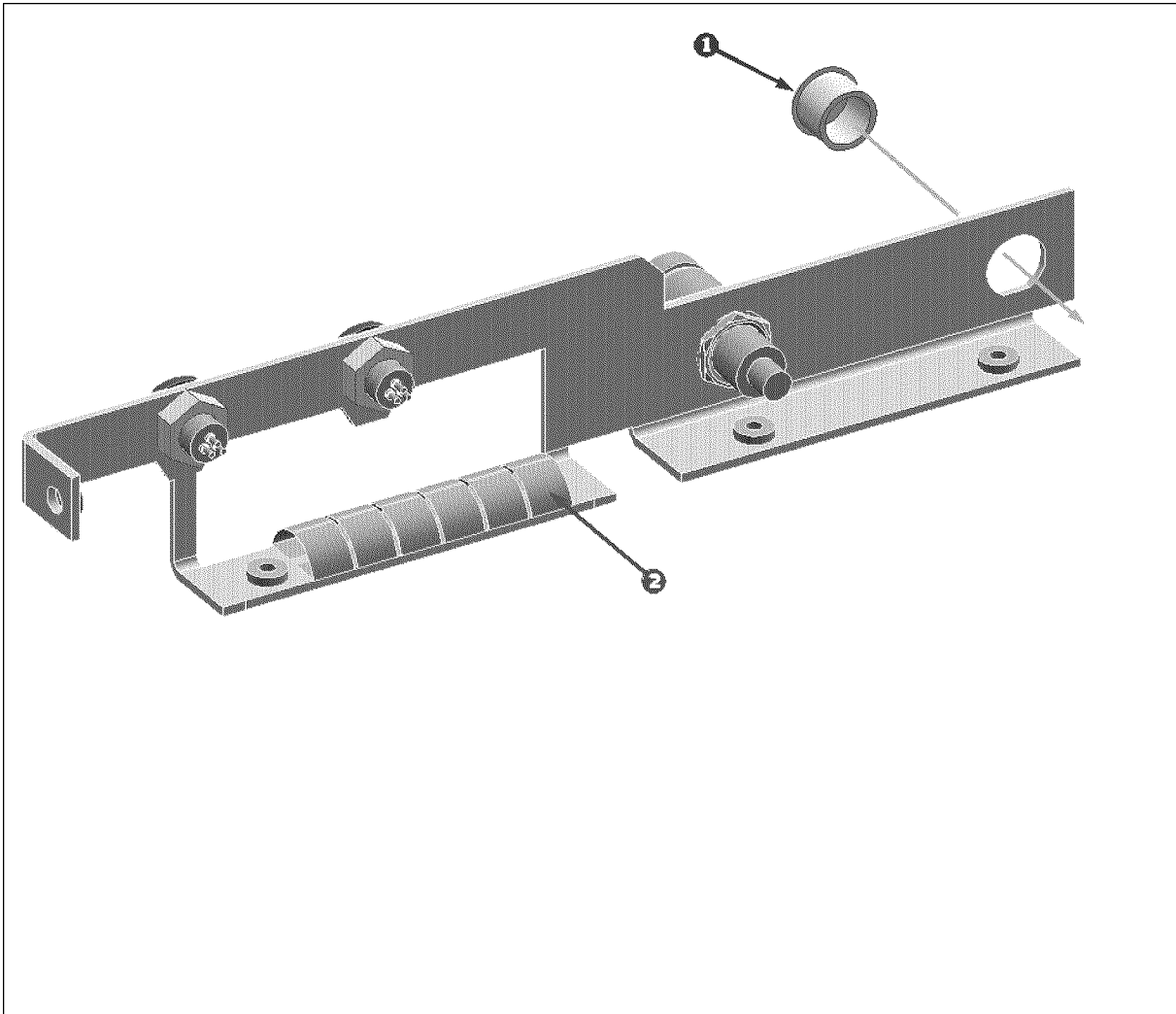


CCS06021

**Figure 10-6. Angle Assembly Parts 4/5**

**Table 10-8. Angle Assembly Parts 4/5**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description   | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|---------------|----------|-----------------|
| 1           | E4970-61641         | 7   | 1    | WIRE ASSY     | 28480    | E4970-61641     |
| 2           | 0890-1480           | 9   | 9    | TUB-HEAT SHRK | 28480    | 0890-1480       |

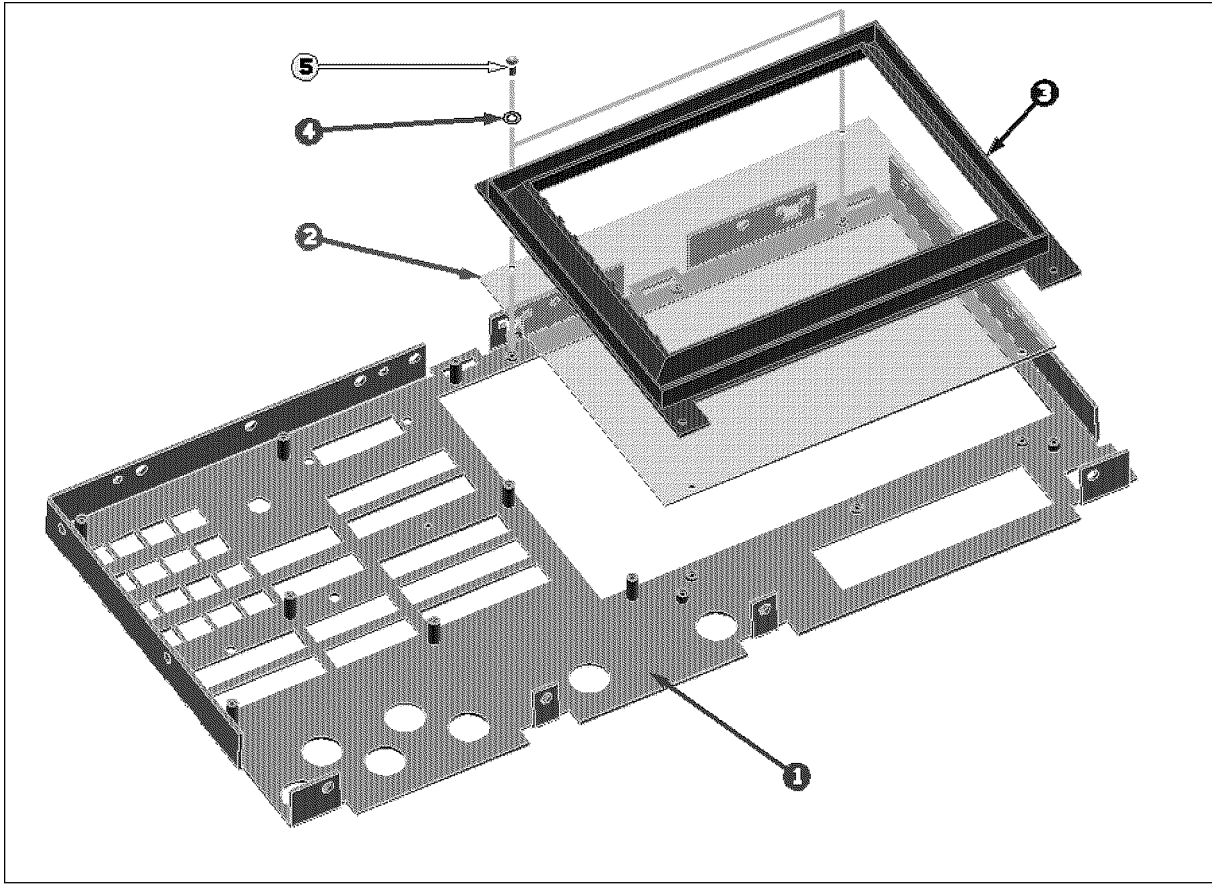


CCS06022

**Figure 10-7. Angle Assembly Parts 5/5**

**Table 10-9. Angle Assembly Parts 5/5**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description   | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|---------------|----------|-----------------|
| 1           | 6960-0150           | 3   | 1    | PLUG-HOLE     | 28480    | 6960-0150       |
| 2           | 8160-0619           | 5   | 0    | SHIELD GASKET | 28480    | 8160-0619       |



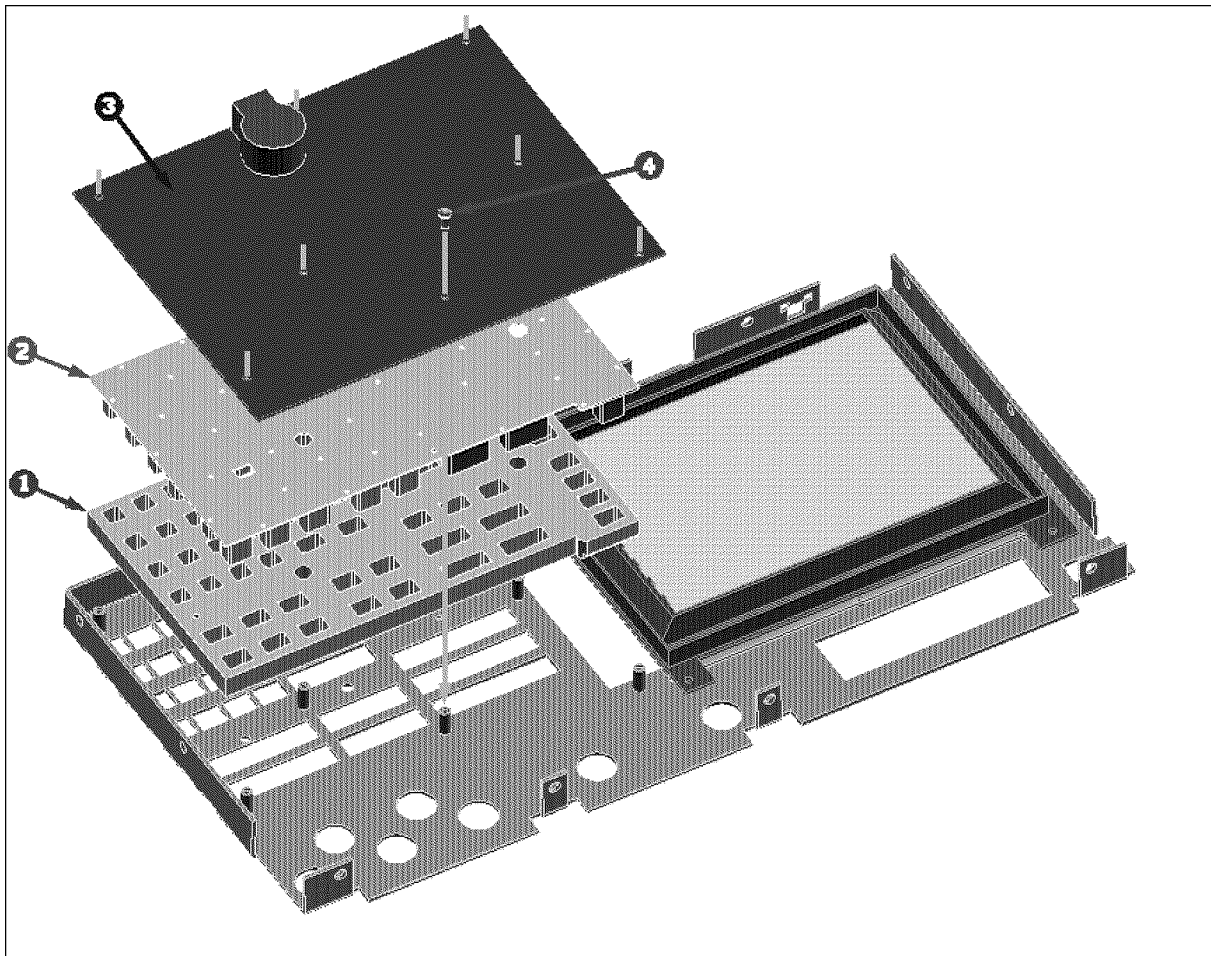
CCS06023

**Figure 10-8. Front Assembly Parts 1/8**

**Table 10-10. Front Assembly Parts 1/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description    | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|----------------|----------|-----------------|
| 1           | E4970-00202         | 8   | 1    | PANEL SUB      | 28480    | E4970-00202     |
| 2           | E4970-25001         | 7   | 1    | FILTER         | 28480    | E4970-25001     |
| 3           | 04396-40071         | 0   | 1    | BEZEL BACK     | 28480    | 04396-40071     |
| 4           | 3050-0891           | 7   | 2    | WASHER M3      | 28480    | 3050-0891       |
| 5           | 0515-1550           | 0   | 3    | SCR M3-L 8 P-H | 28480    | 0515-1550       |

## 10-12 Replaceable Parts

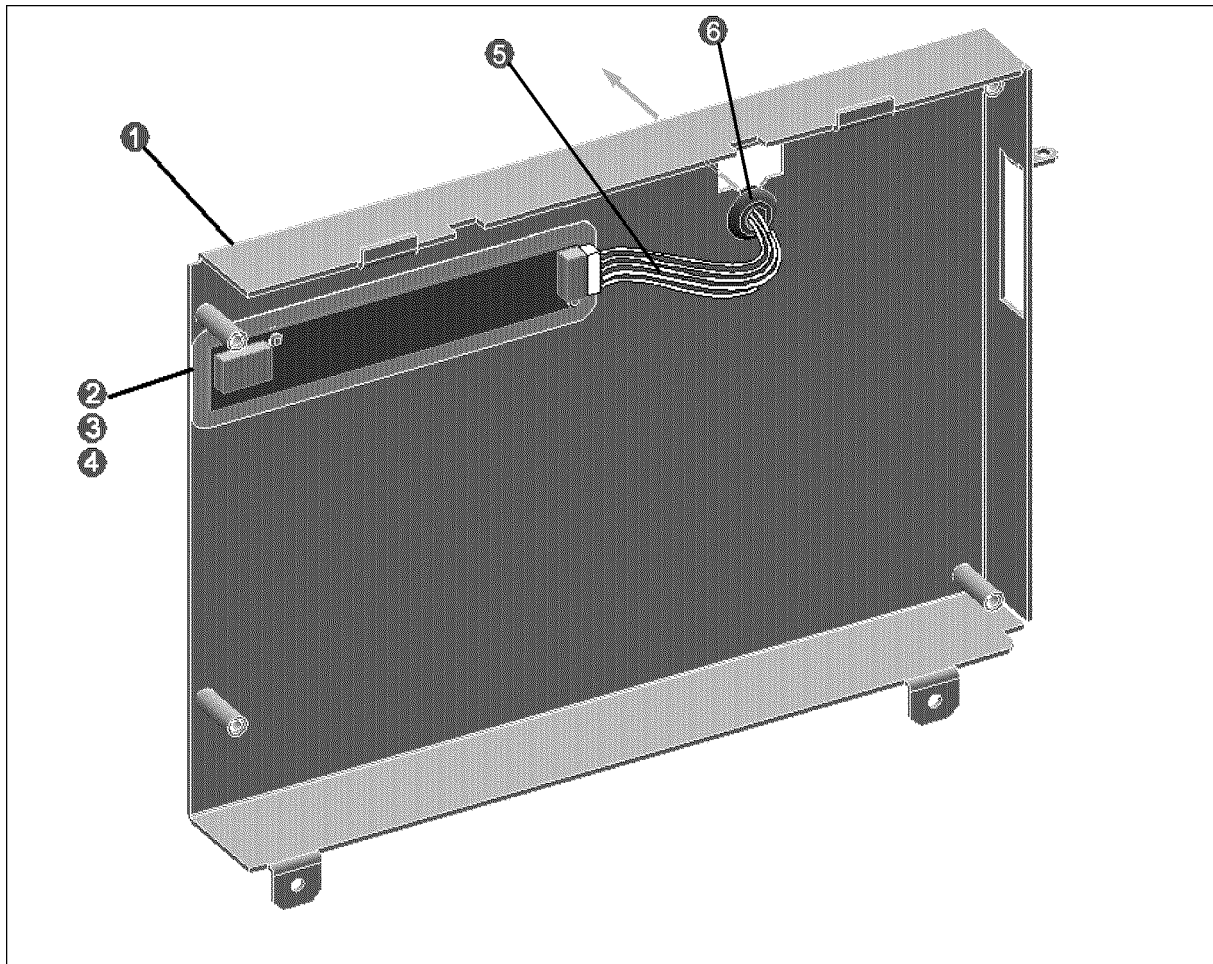


CCS06024

**Figure 10-9. Front Assembly Parts 2/8**

**Table 10-11. Front Assembly Parts 2/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description        | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|--------------------|----------|-----------------|
| 1           | 04396-40003         | 8   | 1    | GUIDE              | 28480    | 04396-40003     |
| 2           | 04396-25051         | 4   | 1    | KEYPAD RUBBER      | 28480    | 04396-25051     |
| 3           | 04396-66530         | 0   | 1    | A30 FRONT KEYBOARD | 28480    | 04396-66530     |
| 4           | 0515-1550           | 0   | 16   | SCR M3-L 8 P-H     | 28480    | 0515-1550       |

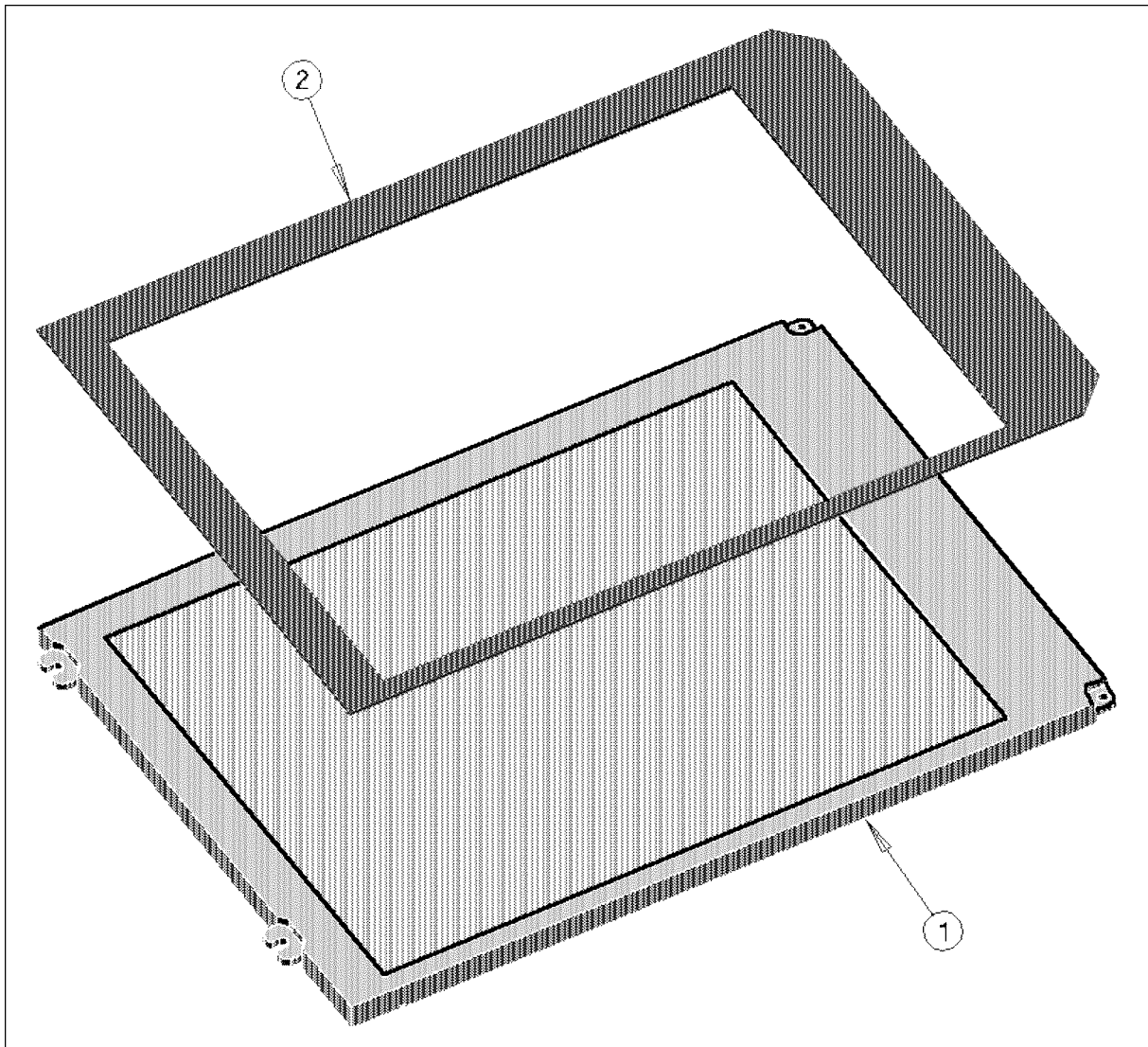


CDS11046

**Figure 10-10. Front Assembly Parts 3/8**

**Table 10-12. Front Assembly Parts 3/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description        | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|--------------------|----------|-----------------|
| 1           | 04352-04014         | 3   | 1    | Cover              | 28480    | 04352-04014     |
| 1           | E4970-25003         | 9   | 1    | Sponge             | 28480    | E4970-25003     |
| 2           | 04352-25002         | 3   | 1    | Insulator          | 28480    | 04352-25002     |
| 3           | 0950-3749           | 5   | 1    | A54 Inverter Board | 28480    | 0950-3749       |
| 4           | 0515-0977           | 3   | 2    | SCR-MACH M2X0.4    | 28480    | 0515-0977       |
| 5           | 04352-61633         | 2   | 1    | Wire Assy          | 28480    | 04352-61633     |
| 6           | 0400-0010           | 2   | 1    | Gromet             | 28480    | 0400-0010       |

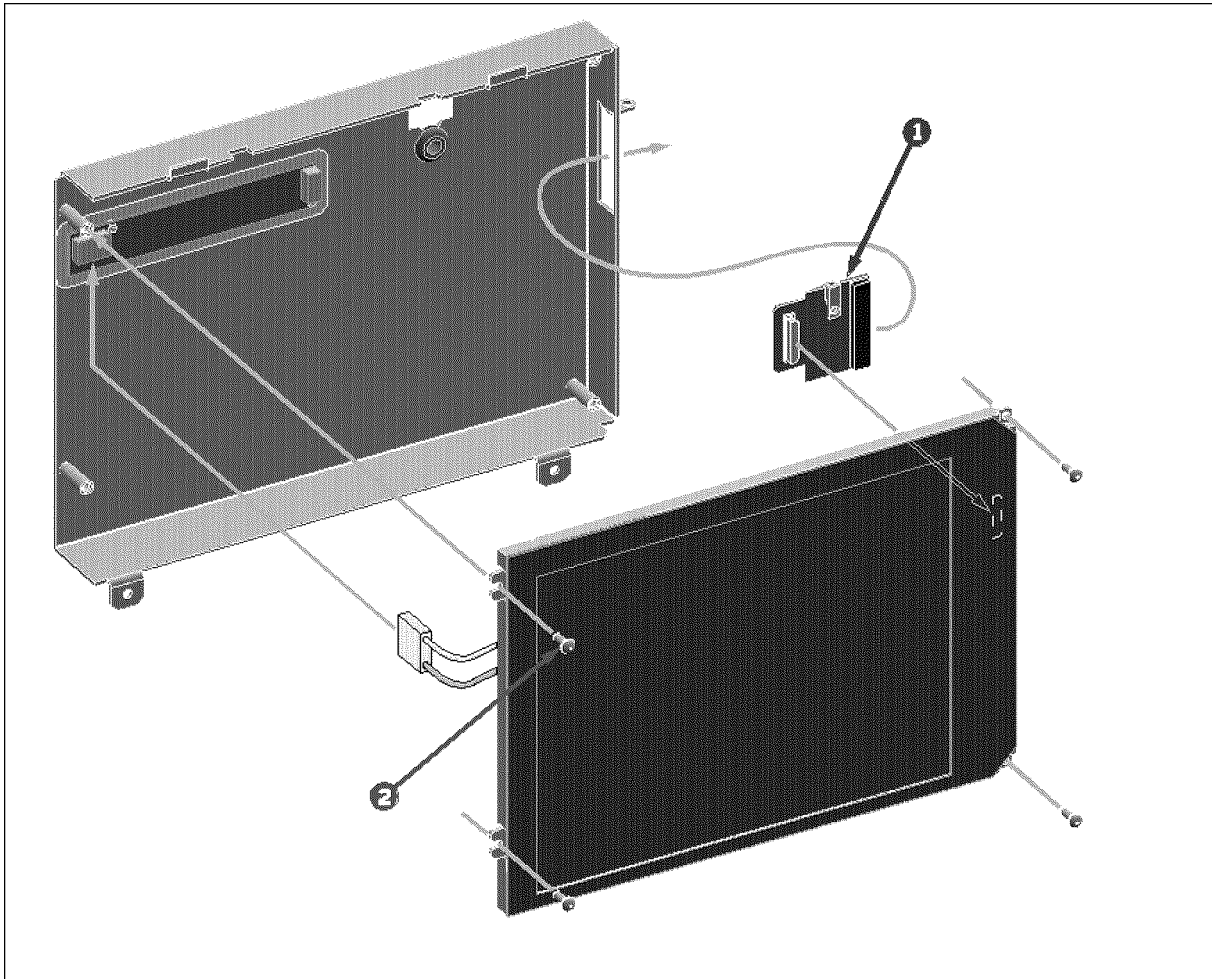


CDS11006

**Figure 10-11. Front Assembly Parts 4/8**

**Table 10-13. Front Assembly Parts 4/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-------------|----------|-----------------|
| 1           | 2090-0361           | 9   | 1    | A52 LCD     | 28480    | 2090-0361       |
| 2           | 04396-25071         | 8   | 1    | Gasket      | 28480    | 04396-25071     |



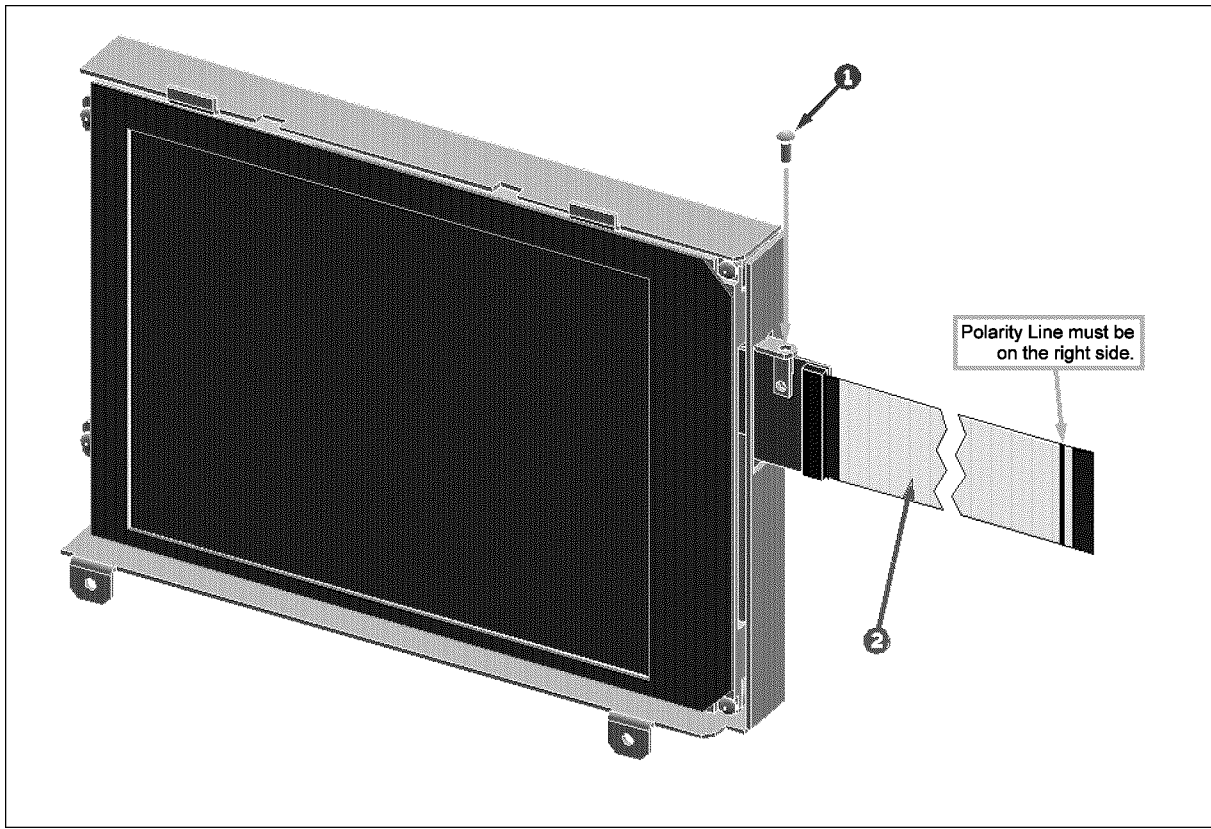
CDS11047

**Figure 10-12. Front Assembly Parts 5/8**

**Table 10-14. Front Assembly Parts 5/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description    | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|----------------|----------|-----------------|
| 1           | E4970-66540         | 5   | 1    | LCD MINI-BD    | 28480    | E4970-66540     |
| 2           | 0515-1550           | 0   | 4    | SCR M3-L 8 P-H | 28480    | 0515-1550       |



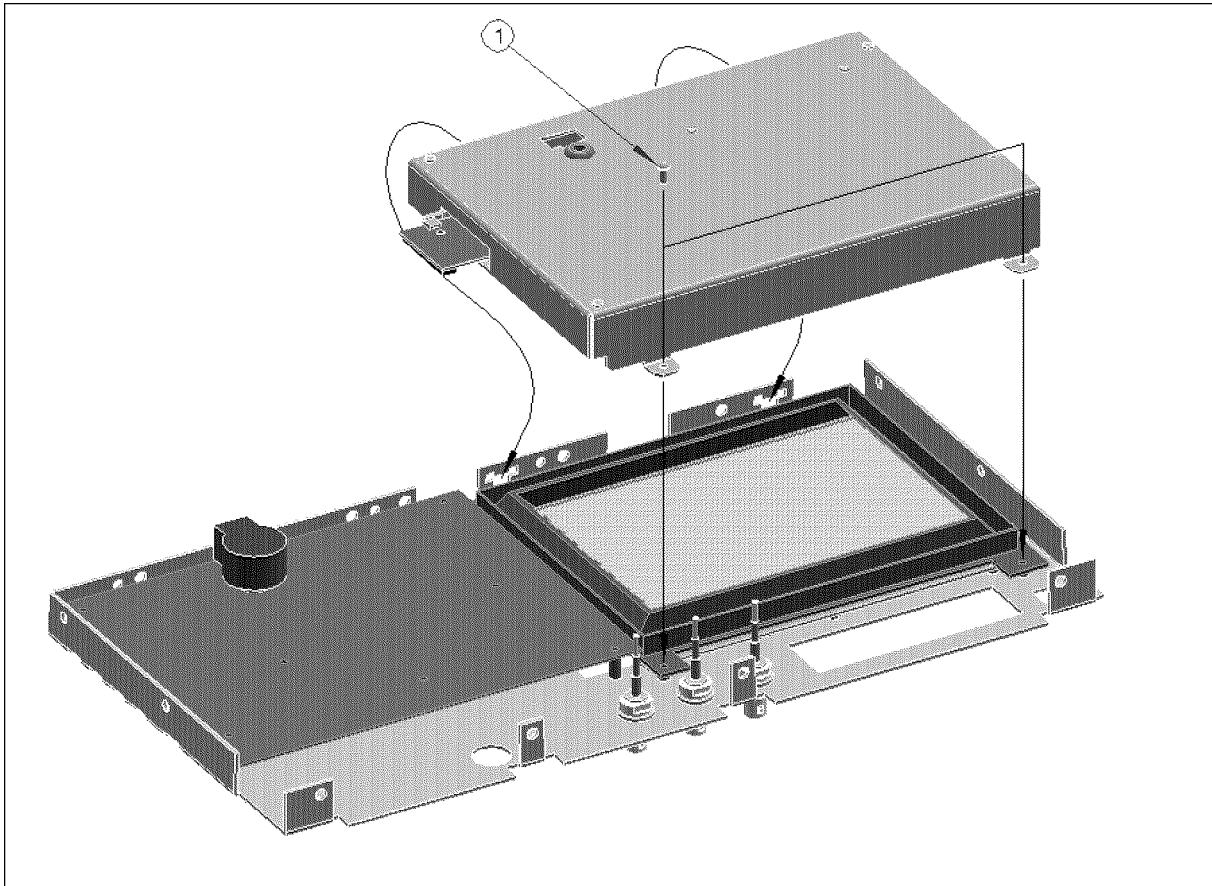


CDS11048

**Figure 10-13. Front Assembly Parts 6/8**

**Table 10-15. Front Assembly Parts 6/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description    | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|----------------|----------|-----------------|
| 1           | 0515-1550           | 0   | 1    | SCR M3-L 8 P-H | 28480    | 0515-1550       |
| 2           | E4970-61651         | 9   | 1    | FLAT CBL FFC   | 28480    | E4970-61651     |

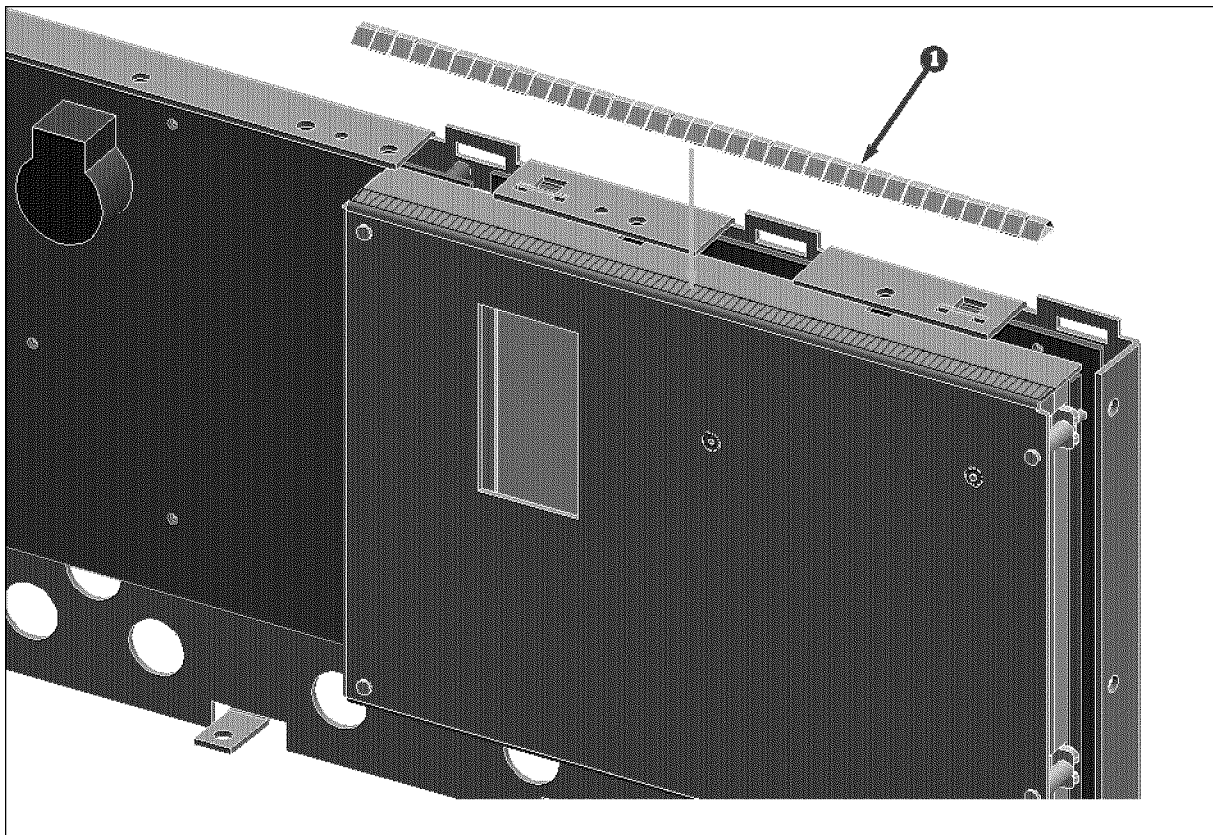


CDS11049

**Figure 10-14. Front Assembly Parts 7/8**

**Table 10-16. Front Assembly Parts 7/8**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description    | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|----------------|-------------|--------------------|
| 1              | 0515-1550              | 0      | 2    | SCR M3-L 8 P-H | 28480       | 0515-1550          |

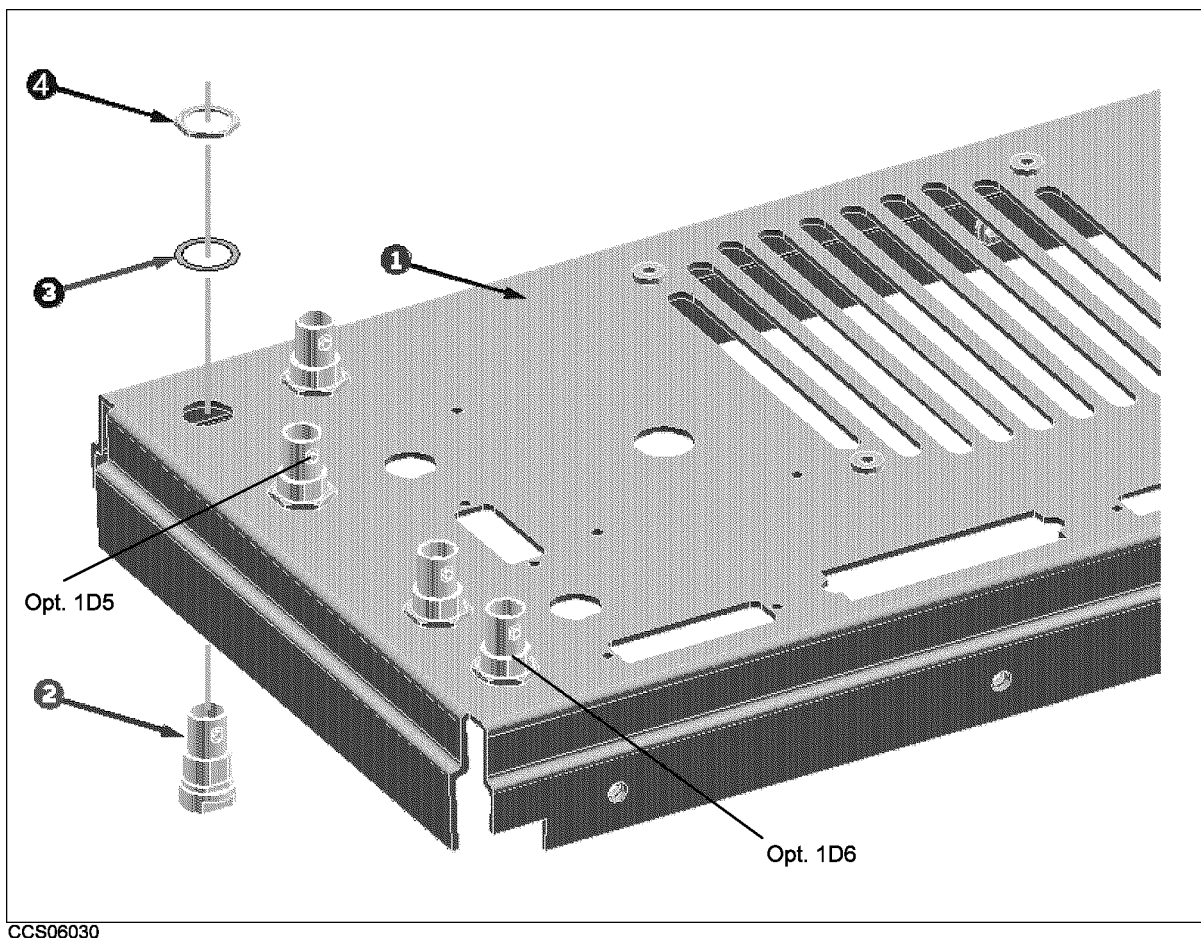


CCS06029

**Figure 10-15. Front Assembly Parts 8/8**

**Table 10-17. Front Assembly Parts 8/8**

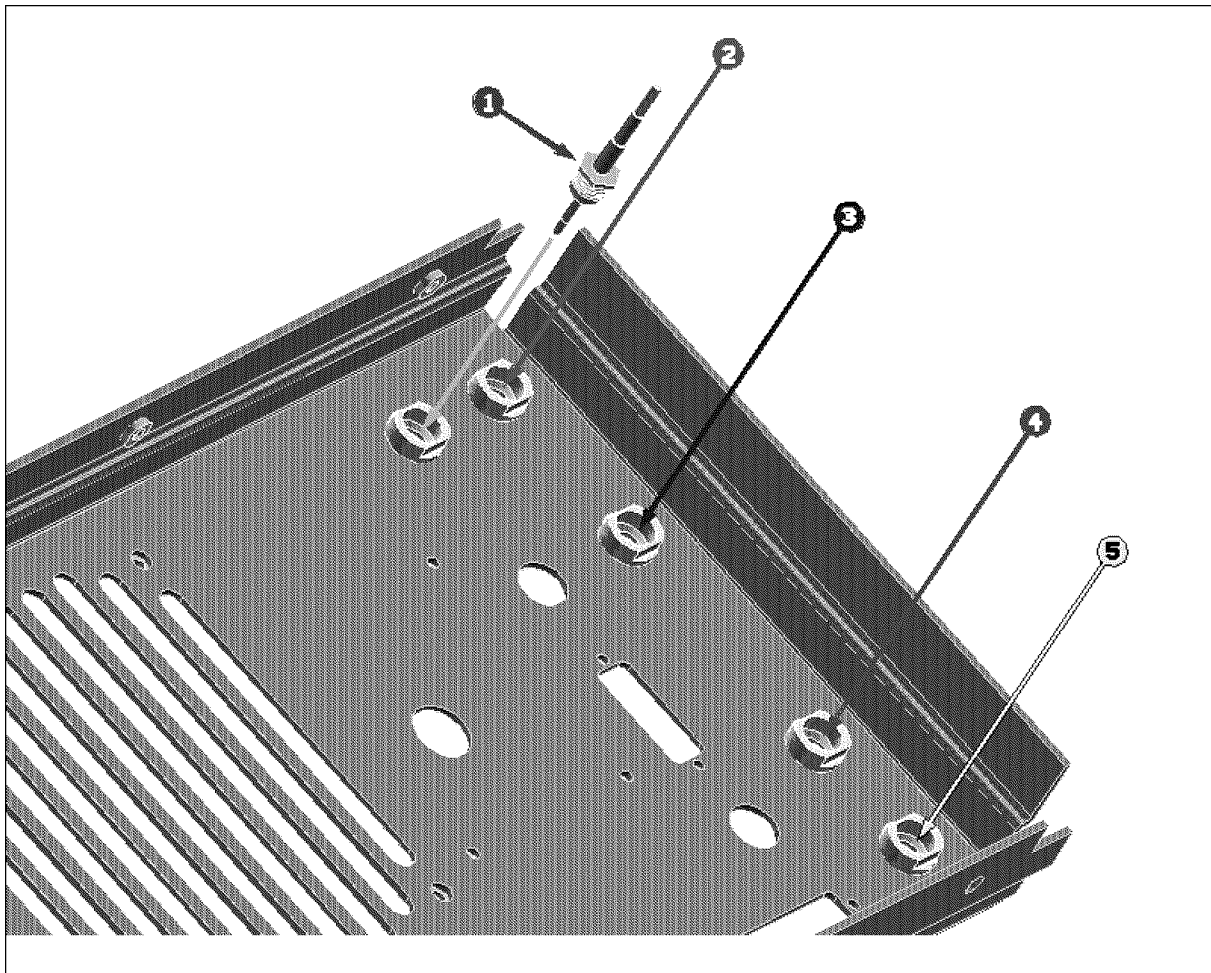
| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|-------------|-------------|--------------------|
| 1              | 0363-0170              | 5      | 0    | RFI GASKET  | 28480       | 0363-0170          |



**Figure 10-16. Rear Assembly Parts 1/8**

**Table 10-18. Rear Assembly Parts 1/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description      | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|------------------|----------|-----------------|
| 1           | E4970-00203         | 9   | 1    | PANEL REAR       | 28480    | E4970-00203     |
| 2           | 1250-0252           | 6   | 3    | CONN-RF BNC      | 28480    | 1250-0252       |
| 3           | 2190-0102           | 8   | 3    | WSHR-LK INTL T   | 28480    | 2190-0102       |
| 4           | 2950-0035           | 8   | 3    | NUT-HEX-DBL-CHAM | 28480    | 2950-0035       |

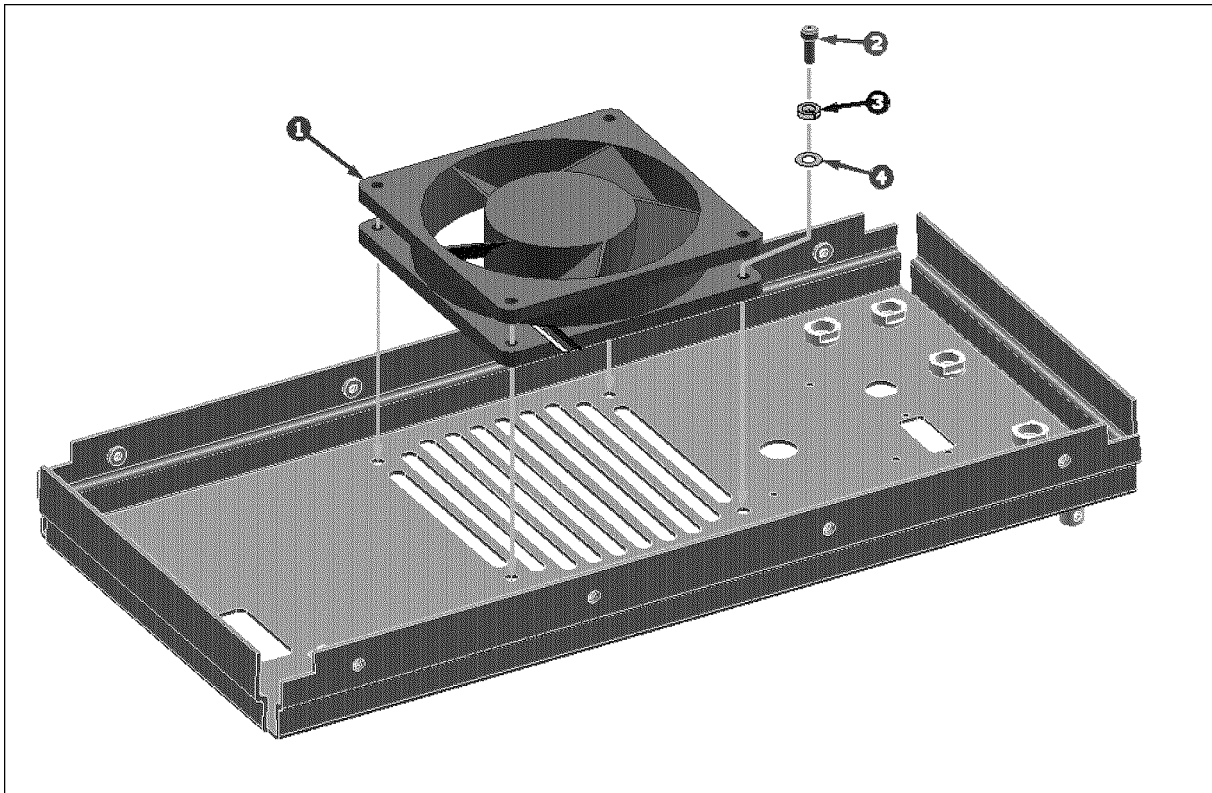


CCS06031

**Figure 10-17. Rear Assembly Parts 2/8**

**Table 10-19. Rear Assembly Parts 2/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description                | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|----------------------------|----------|-----------------|
| 1           | E4970-61621         | 3   | 1    | RF CBL ASSY                | 28480    | E4970-61621     |
| 2           | E4970-61622         | 4   | 1    | RF CBL ASSY                | 28480    | E4970-61622     |
| 3           | E4970-61627         | 9   | 1    | RF CBL ASSY "V" (Opt. 1D5) | 28480    | E4970-61627     |
| 4           | 04396-61635         | 6   | 1    | RF CBL ASSY                | 28480    | 04396-61635     |
| 5           | 04396-61637         | 8   | 1    | RF CBL ASSY "T" (Opt. 1D6) | 28480    | 04396-61637     |

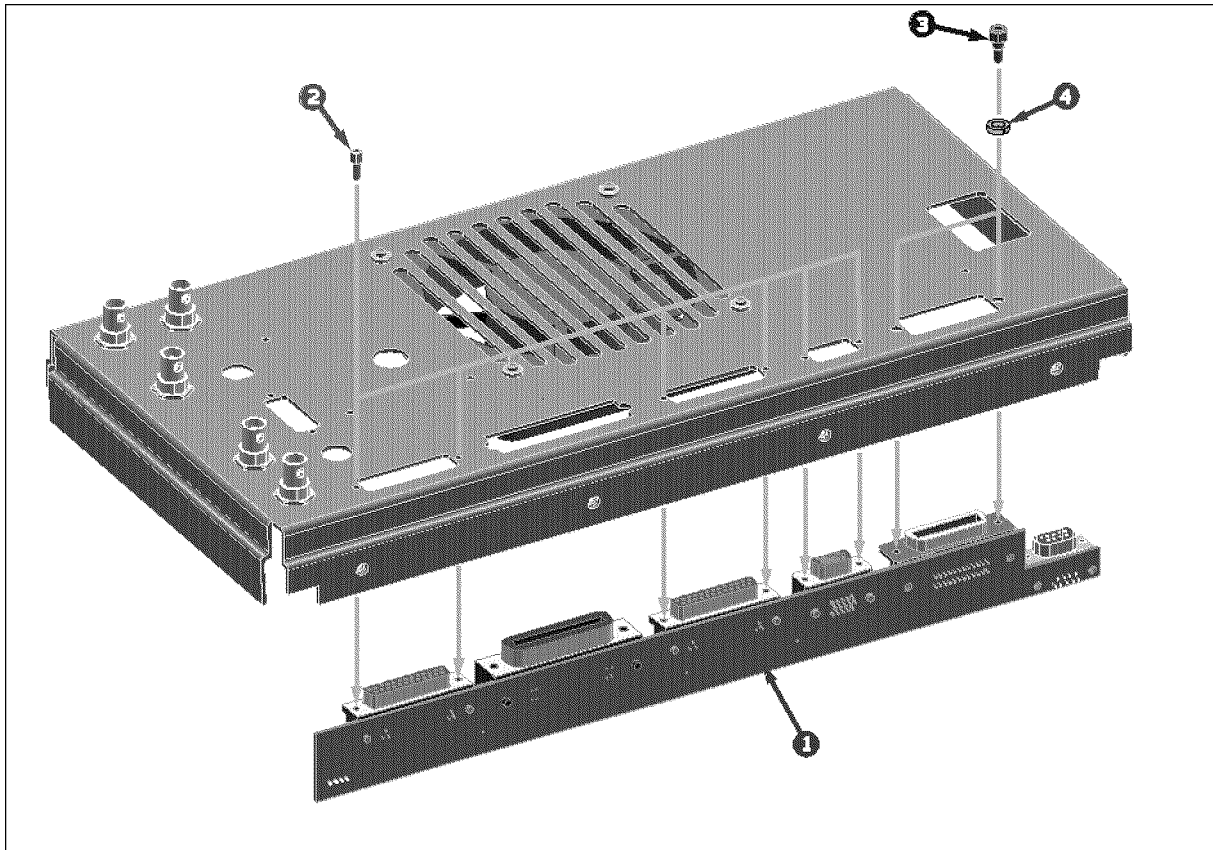


CCS06032

**Figure 10-18. Rear Assembly Parts 3/8**

**Table 10-20. Rear Assembly Parts 3/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description  | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|--------------|----------|-----------------|
| 1           | 04396-61001         | 0   | 1    | FAN ASSY     | 28480    | 04396-61001     |
| 2           | 0515-1598           | 6   | 4    | SCR SKT-HEAD | 28480    | 0515-1598       |
| 3           | 2190-0586           | 2   | 4    | WSHR-LK HLCL | 28480    | 2190-0586       |
| 4           | 3050-0893           | 9   | 4    | WSHR-FL      | 28480    | 3050-0893       |

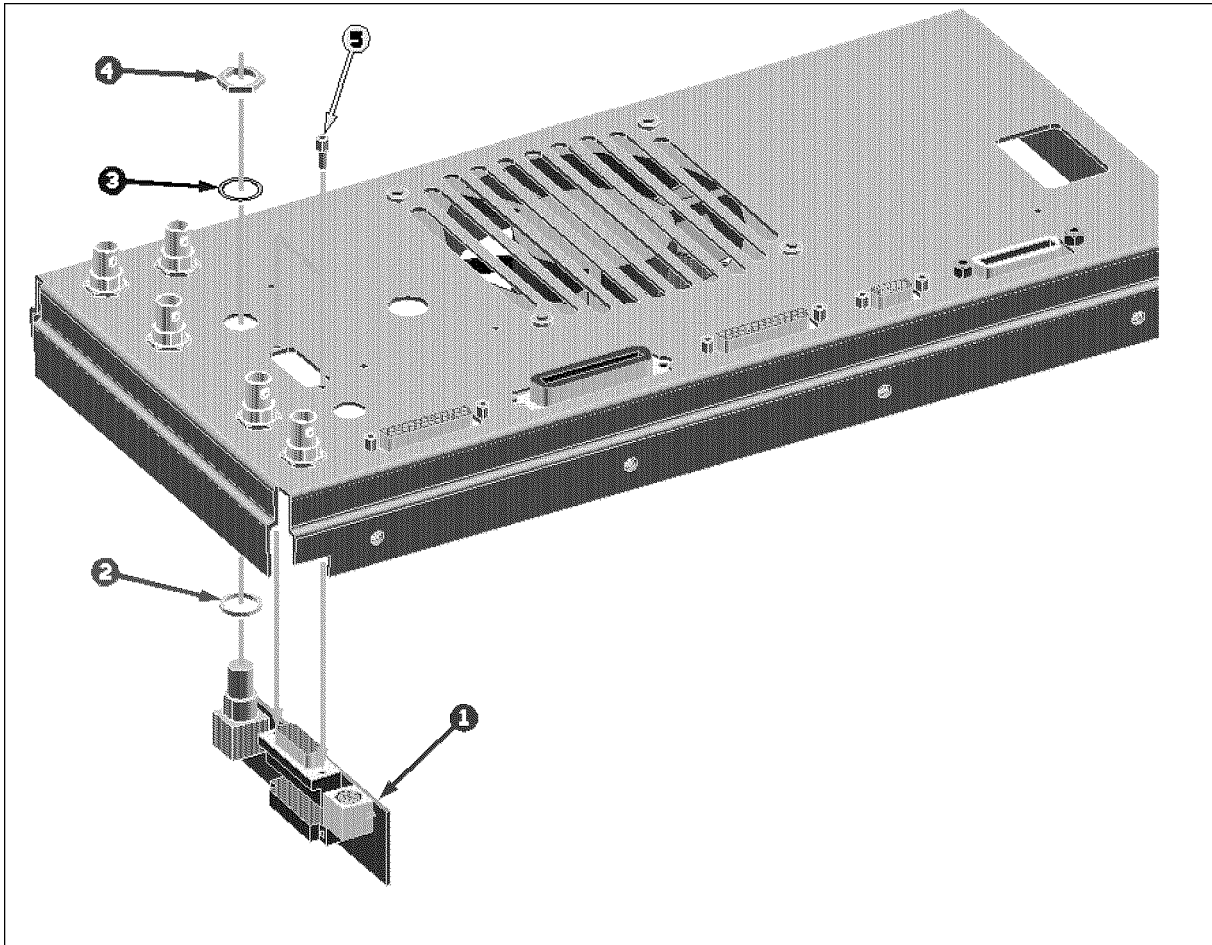


CCS06033

**Figure 10-19. Rear Assembly Parts 4/8**

**Table 10-21. Rear Assembly Parts 4/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description    | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|----------------|----------|-----------------|
| 1           | E4970-66533         | 6   | 1    | A33 EXT I/O    | 28480    | E4970-66533     |
| 2           | 1251-7812           | 0   | 8    | JACKSCREW      | 28480    | 1251-7812       |
| 3           | 0380-0644           | 4   | 2    | STDF-HEX-M/FEM | 28480    | 0380-0644       |
| 4           | 2190-0577           | 1   | 2    | WSHR-LK HLCL   | 28480    | 2190-0577       |



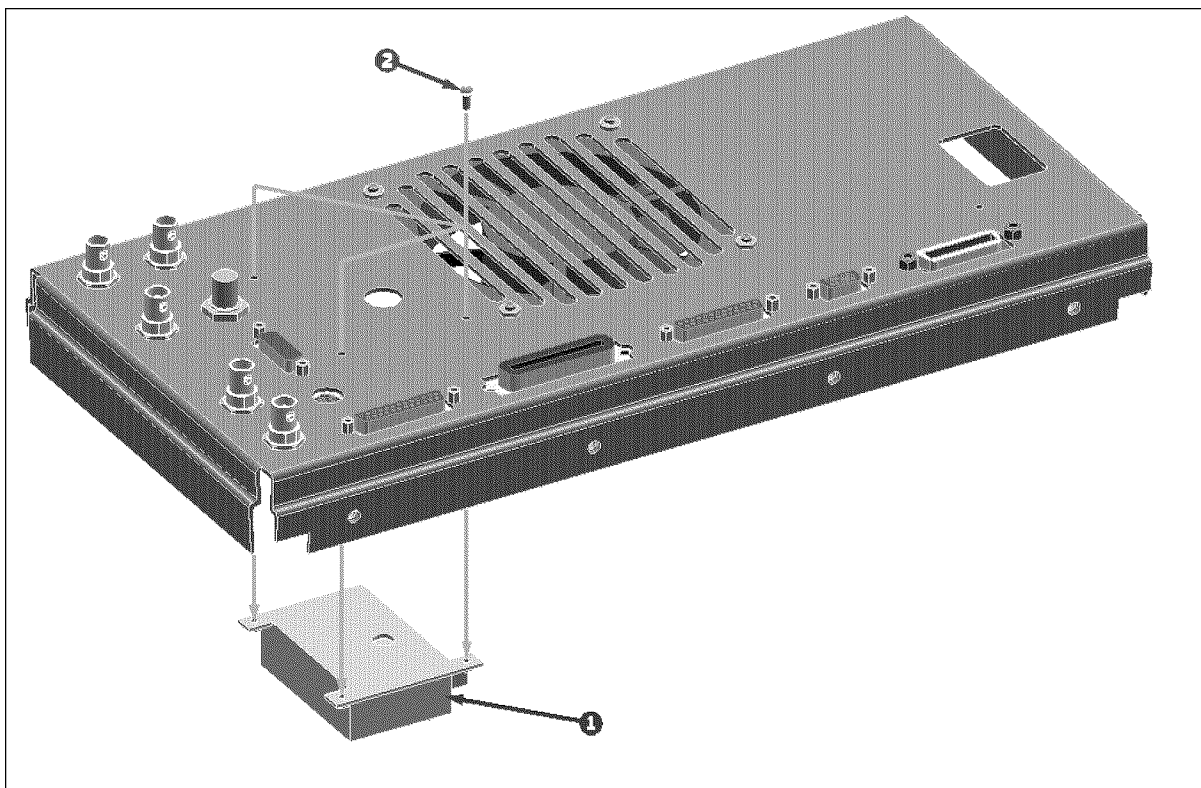
CCS06034

**Figure 10-20. Rear Assembly Parts 5/8**

**Table 10-22. Rear Assembly Parts 5/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description      | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|------------------|----------|-----------------|
| 1           | E4970-66532         | 5   | 1    | A32 IBASIC I/F   | 28480    | E4970-66532     |
| 2           | 3050-1546           | 1   | 1    | WASHER FLAT NM   | 28480    | 3050-1546       |
| 3           | 2190-0054           | 9   | 1    | WSHR-LK INTL T   | 28480    | 2190-0054       |
| 4           | 2950-0054           | 1   | 1    | NUT-HEX-DBL-CHAM | 28480    | 2950-0054       |
| 5           | 1251-7812           | 0   | 8    | JACKSCREW        | 28480    | 1251-7812       |



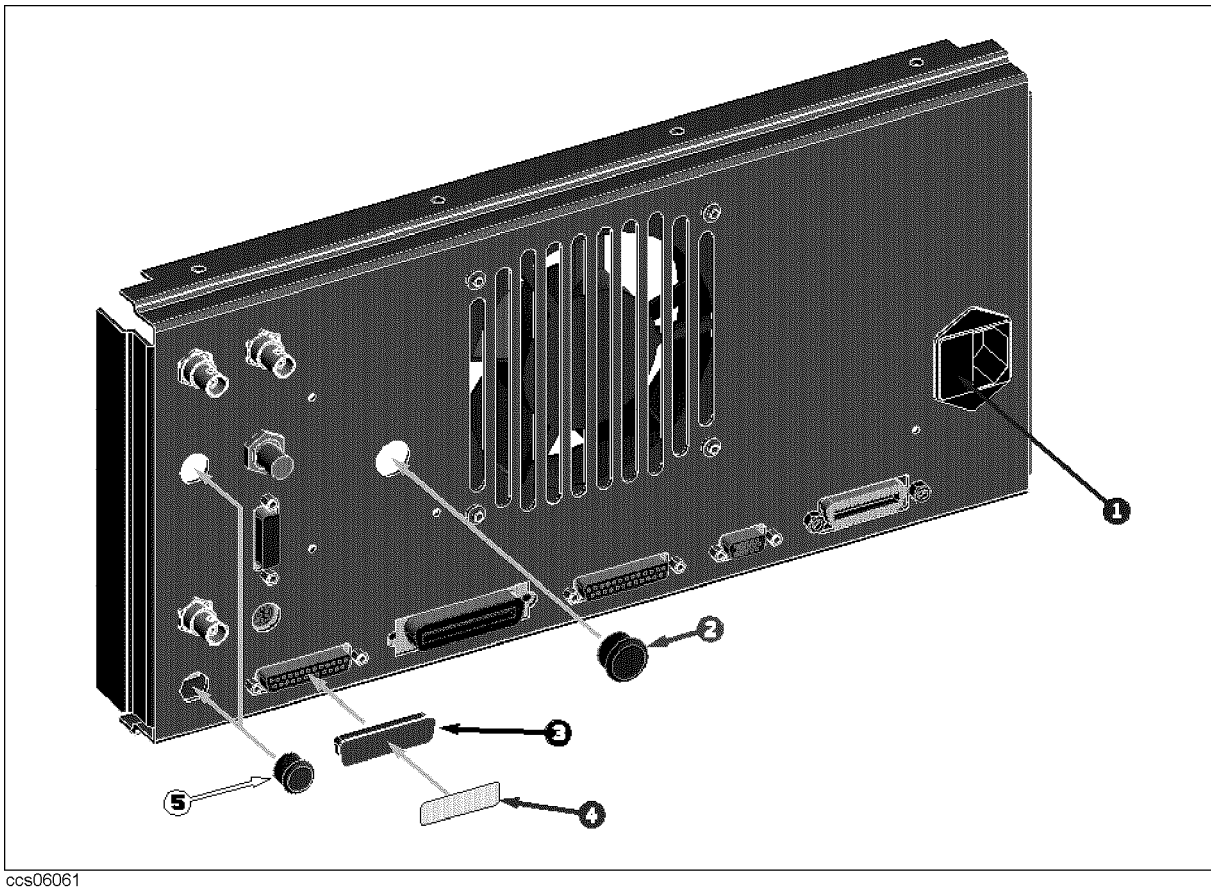


CCS06035

**Figure 10-21. Rear Assembly Parts (Opt. 1D5) 6/8**

**Table 10-23. Rear Assembly Parts (Opt. 1D5) 6/8**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description          | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|----------------------|-------------|--------------------|
| 1              | 04395-61060            | 0      | 1    | OVEN XTAL (Opt. 1D5) | 28480       | 04395-61060        |
| 2              | 0515-1550              | 0      | 3    | SCR M3-L 8 P-H       | 28480       | 0515-1550          |

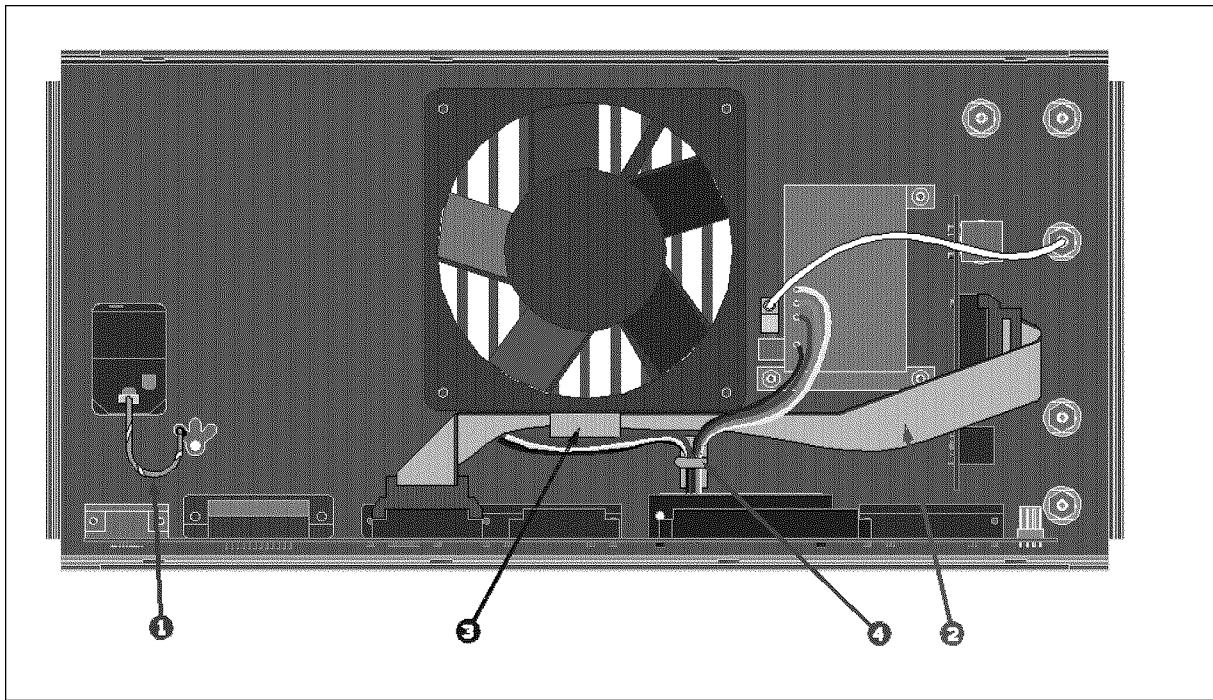


ccs06061

**Figure 10-22. Rear Assembly Parts 7/8**

**Table 10-24. Rear Assembly Parts 7/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description  | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|--------------|----------|-----------------|
| 1           | 2110-1303           | 5   | 1    | FUSE 5A 250V | 28480    | 2110-1303       |
| 2           | 6960-0027           | 3   | 1    | PLUG-HOLE    | 28480    | 6960-0027       |
| 3           | 1252-4690           | 8   | 1    | DUST COVER   | 28480    | 1252-4690       |
| 4           | 04396-87111         | 7   | 1    | LABEL        | 28480    | 04396-87111     |
| 5           | 6960-0041           | 1   | 2    | PLUG HOLE    | 28480    | 6960-0041       |

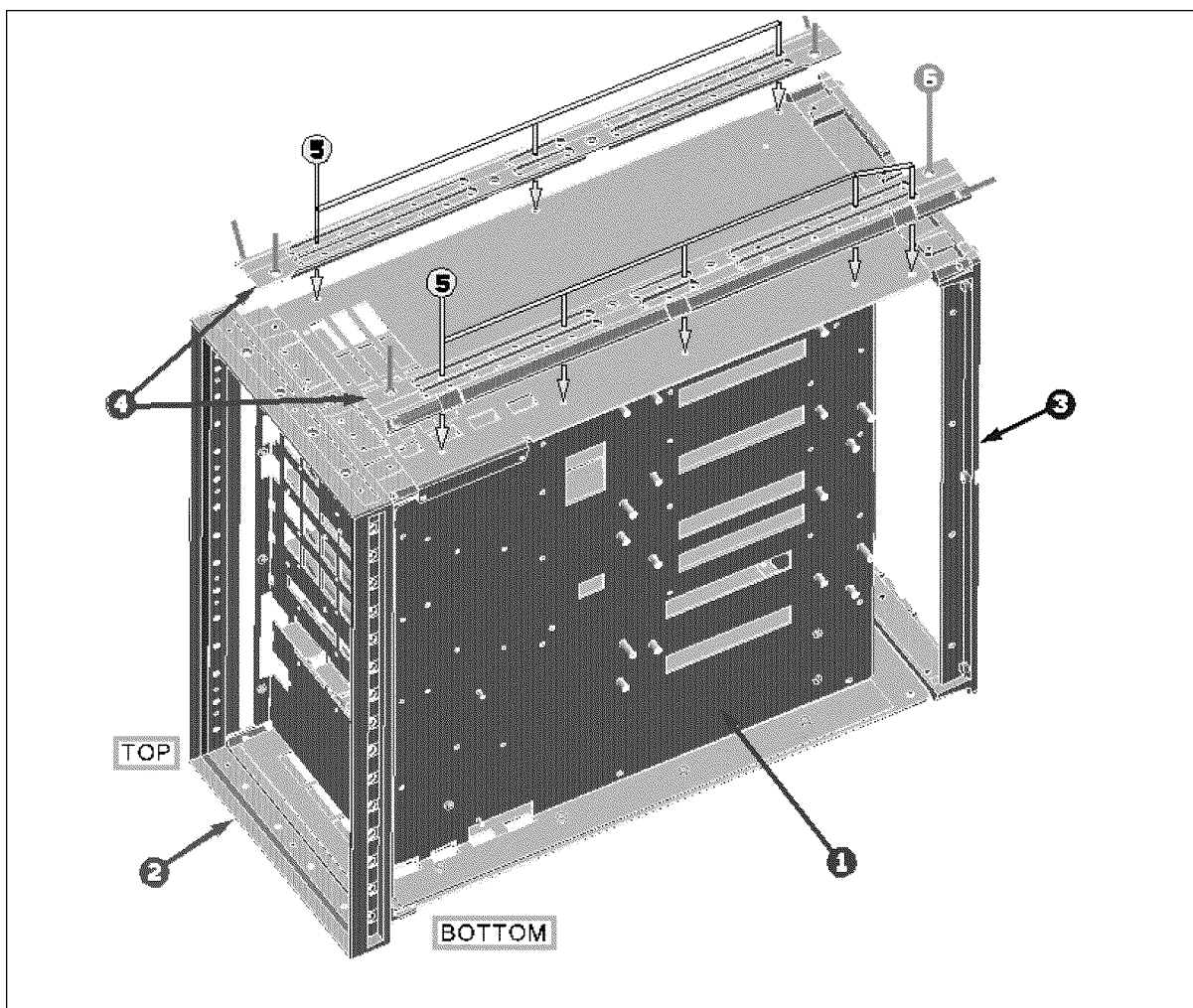


CCS06037

**Figure 10-23. Rear Assembly Parts 8/8**

**Table 10-25. Rear Assembly Parts 8/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description   | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|---------------|----------|-----------------|
| 1           | E5100-61640         | 6   | 3    | WIRE ASSY GND | 28480    | E5100-61640     |
| 2           | 04396-61706         | 2   | 1    | CABLE ASSY    | 28480    | 04396-61706     |
| 3           | 1400-0611           | 0   | 1    | CLAMP-CABLE   | 28480    | 1400-0611       |
| 4           | 1400-1334           | 6   | 1    | CLAMP CABLE   | 28480    | 1400-1334       |

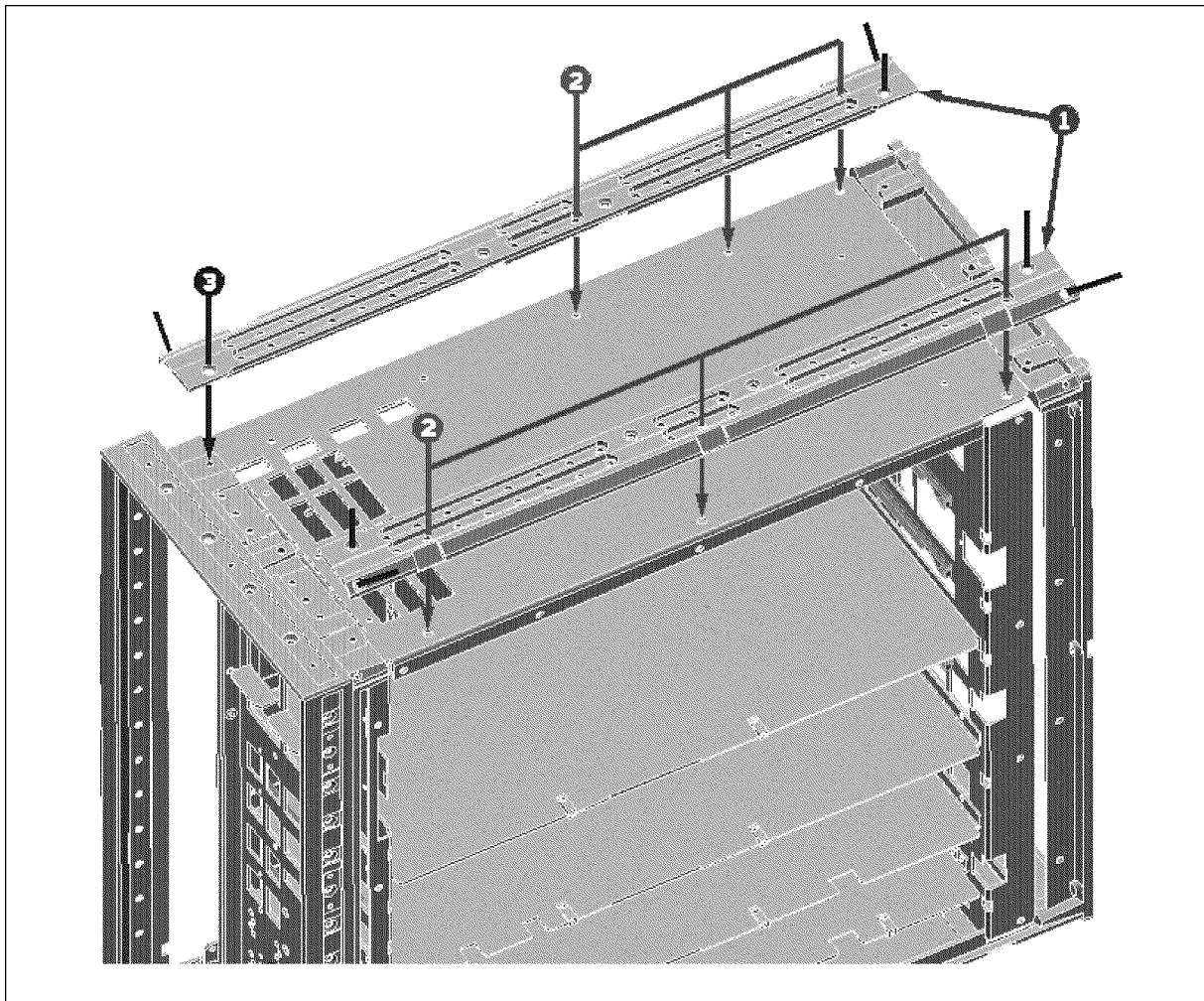


CCS06038

**Figure 10-24. Main Frame Assembly Parts 1/23**

**Table 10-26. Main Frame Assembly Parts 1/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description      | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|------------------|----------|-----------------|
| 1           | E4970-60001         | 1   | 1    | CHASSIS ASSY     | 28480    | E4970-60001     |
| 2           | 5022-1190           | 4   | 1    | FRONT FRAME221.5 | 28480    | 5022-1190       |
| 3           | 5021-5808           | 7   | 1    | RR-FR 221.5XFM   | 28480    | 5021-5808       |
| 4           | 5021-5837           | 2   | 4    | STRUT COR 497.8D | 28480    | 5021-5837       |
| 5           | 0515-1719           | 3   | 25   | SCR M4X10        | 28480    | 0515-1719       |
| 6           | 0515-1668           | 1   | 16   | SCR-MTRC SPCLY   | 28480    | 0515-1668       |

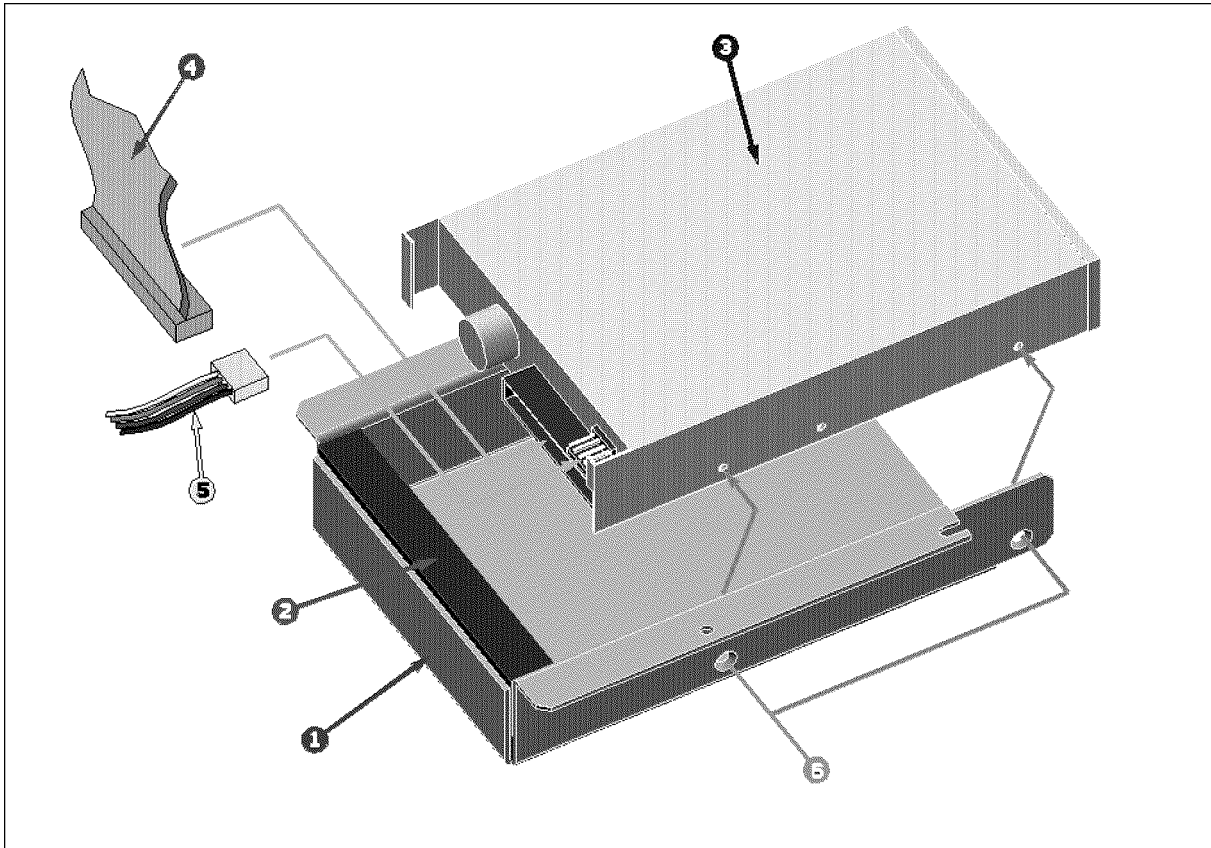


CCS06039

**Figure 10-25. Main Frame Assembly Parts 2/23**

**Table 10-27. Main Frame Assembly Parts 2/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description      | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|------------------|----------|-----------------|
| 1           | 5021-5837           | 2   | 4    | STRUT COR 497.8D | 28480    | 5021-5837       |
| 2           | 0515-1719           | 3   | 25   | SCR M4X10        | 28480    | 0515-1719       |
| 3           | 0515-1668           | 1   | 16   | SCR-MTRC SPCLY   | 28480    | 0515-1668       |

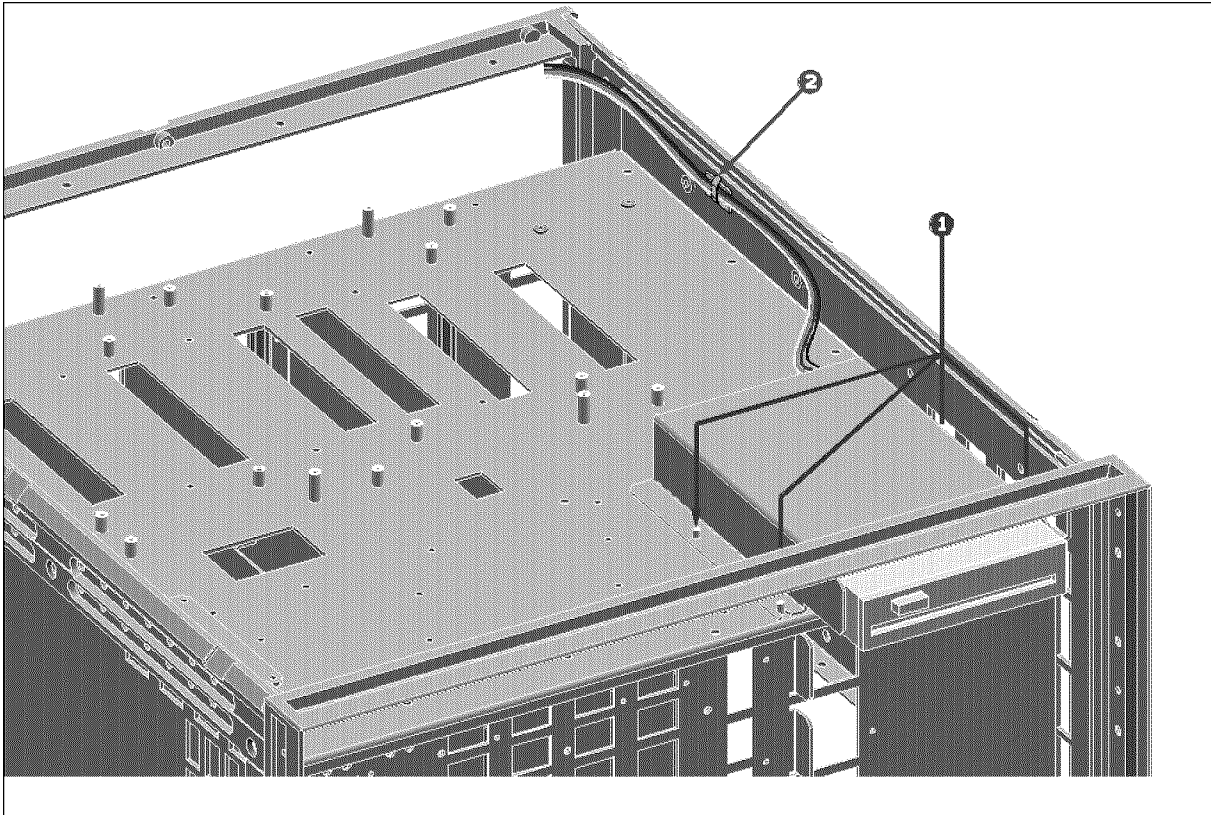


CCS06040

**Figure 10-26. Main Frame Assembly Parts (FDD Assembly) 3/23**

**Table 10-28. Main Frame Assembly Parts (FDD Assembly) 3/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description     | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-----------------|----------|-----------------|
| 1           | 04396-01275         | 4   | 3    | ANGLE           | 28480    | 04396-01275     |
| 2           | 04396-25004         | 7   | 1    | SPONGE          | 28480    | 04396-25004     |
| 3           | 0950-3334           | 4   | 1    | FDD 3.5 2MODE   | 28480    | 0950-3334       |
| 4           | 04396-61651         | 6   | 1    | FLAT CBL ASSY   | 28480    | 04396-61651     |
| 5           | 04396-61672         | 1   | 1    | WIRE ASSY       | 28480    | 04396-61672     |
| 6           | 0515-0914           | 8   | 31   | SCR-MACH M3X0.5 | 28480    | 0515-0914       |

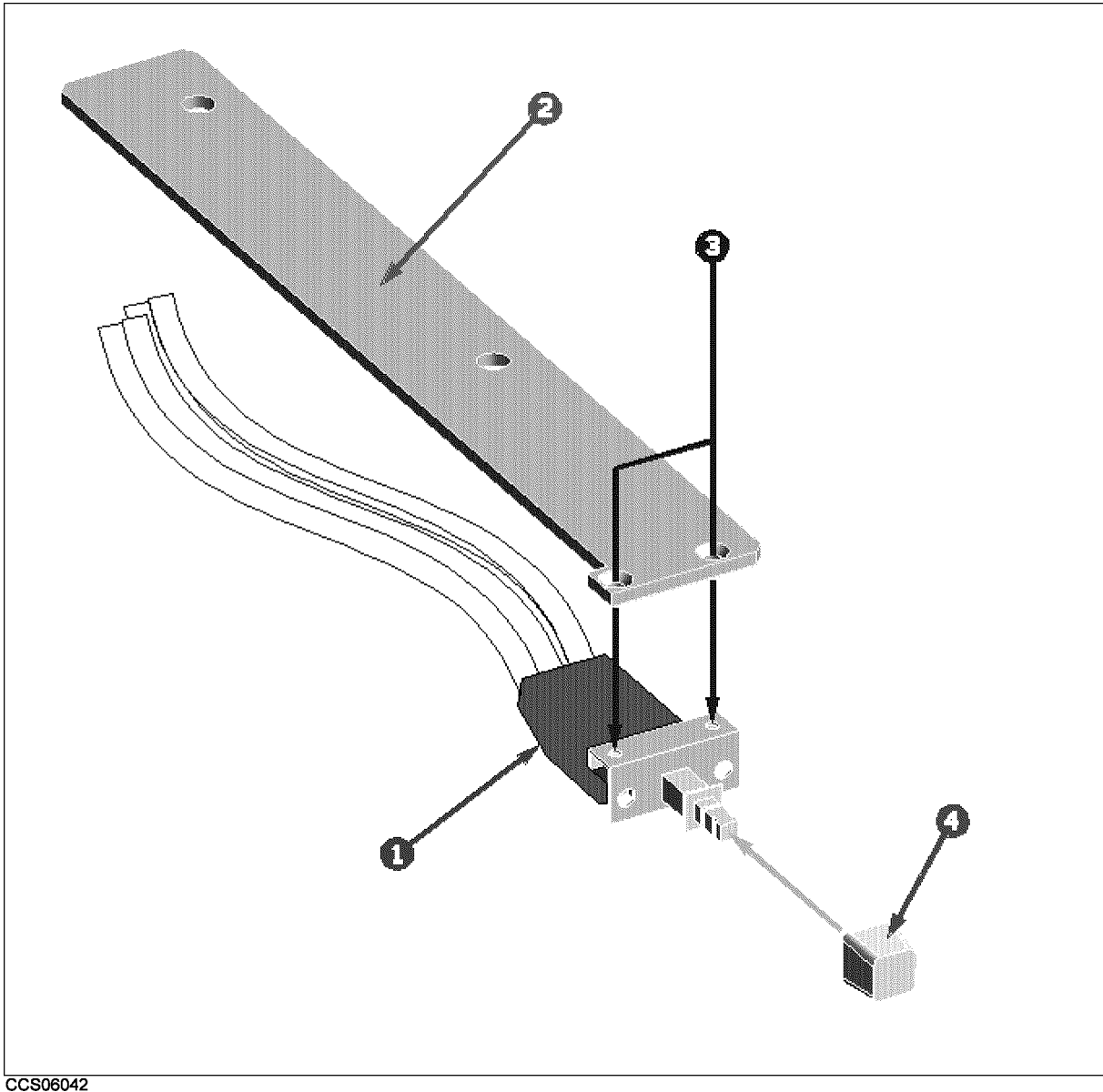


CCS06041

**Figure 10-27. Main Frame Assembly Parts (FDD Assembly) 4/23**

**Table 10-29. Main Frame Assembly Parts (FDD Assembly) 4/23**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description      | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|------------------|-------------|--------------------|
| 1              | 0535-0031              | 2      | 4    | NUT-HEX W/LOCKER | 28480       | 0535-0031          |
| 2              | 1400-1334              | 6      | 4    | CLAMP CABLE      | 28480       | 1400-1334          |



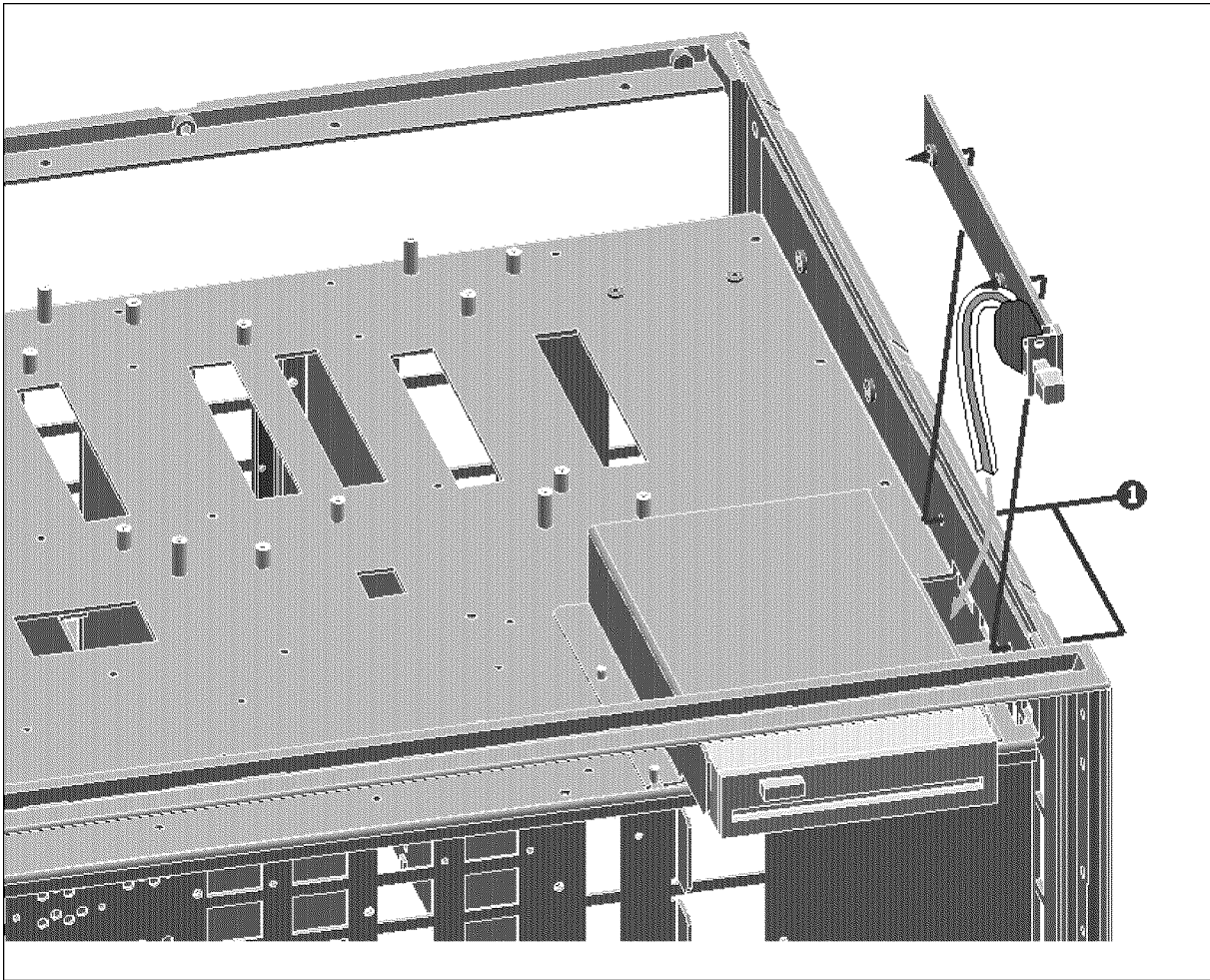
CCS06042

**Figure 10-28. Main Frame Assembly Parts 5/23**

**Table 10-30. Main Frame Assembly Parts 5/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description      | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|------------------|----------|-----------------|
| 1           | 04396-61701         | 7   | 1    | CABLE ASSY       | 28480    | 04396-61701     |
| 2           | 04396-01274         | 3   | 1    | HOLDER           | 28480    | 04396-01274     |
| 3           | 0515-0999           | 9   | 2    | M2.5X0.45 L=6 FL | 28480    | 0515-0999       |
| 4           | 5041-0564           | 4   | 1    | KEY-Q-CORP WHT   | 28480    | 5041-0564       |



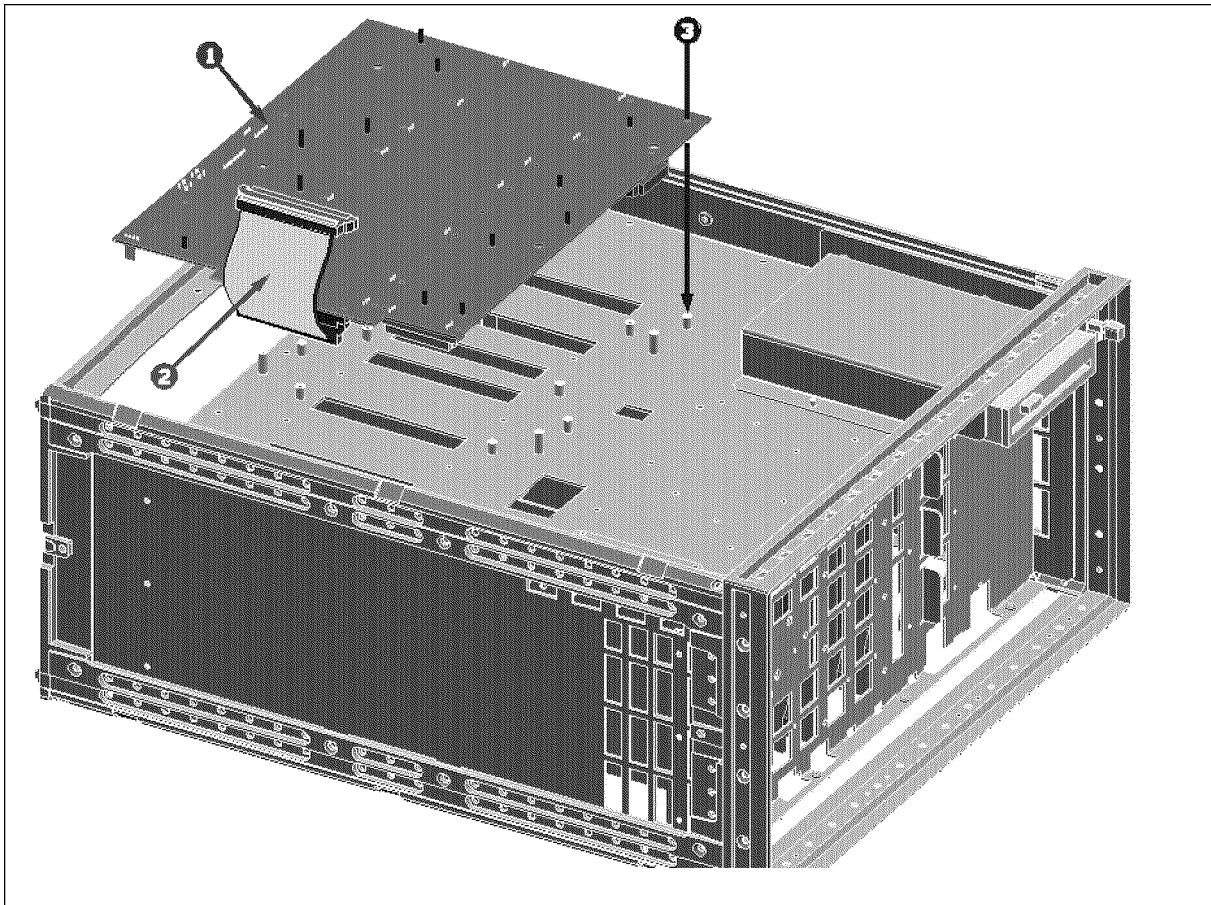


CCS06043

**Figure 10-29. Main Frame Assembly Parts 6/23**

**Table 10-31. Main Frame Assembly Parts 6/23**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|-------------|-------------|--------------------|
| 1              | 0515-1718              | 2      | 1    | SCR M4X12   | 28480       | 0515-1718          |

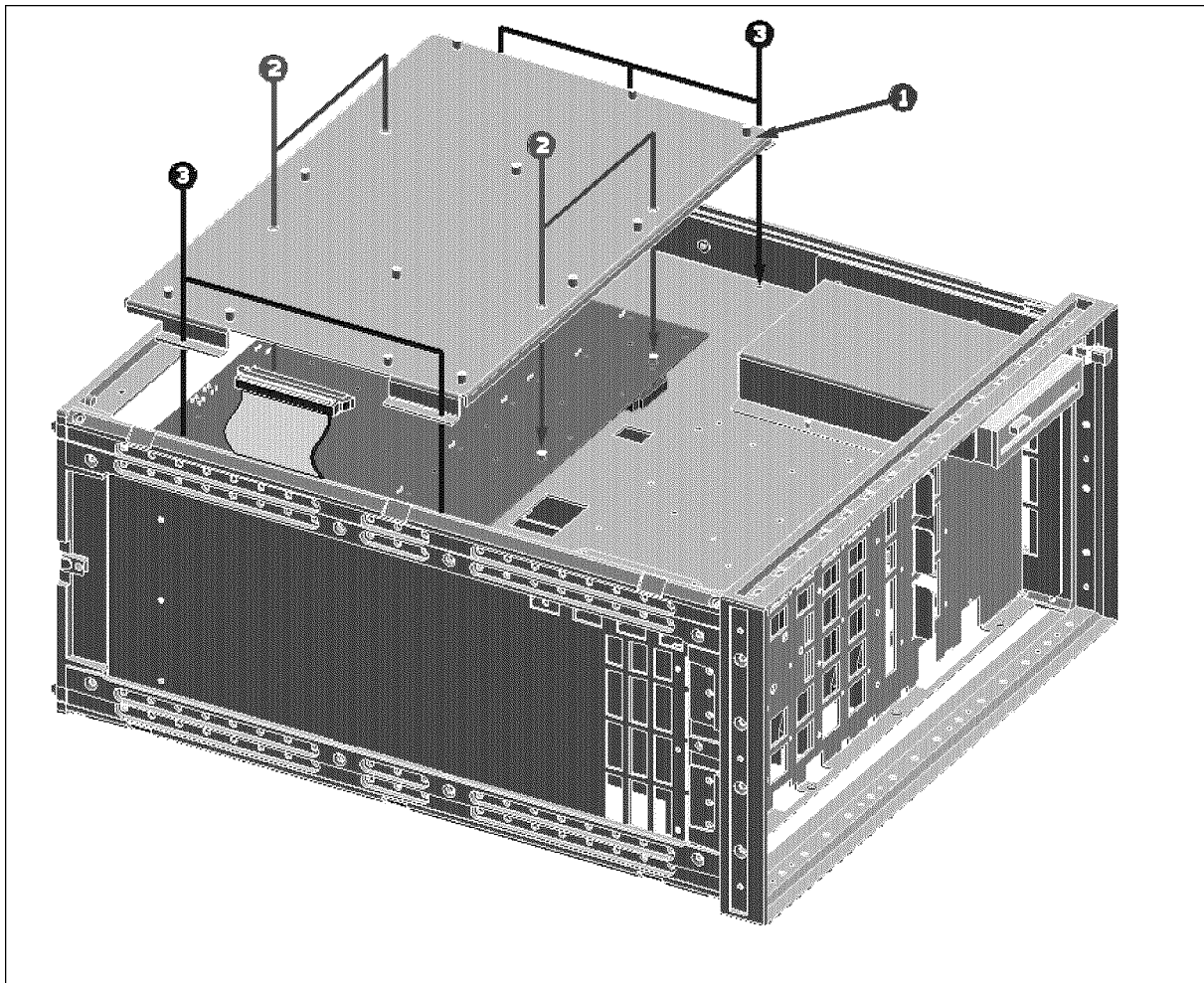


CCS06044

**Figure 10-30. Main Frame Assembly Parts (A20 Motherboard Assembly) 7/23**

**Table 10-32. Main Frame Assembly Parts (A20 Motherboard Assembly) 7/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description      | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|------------------|----------|-----------------|
| 1           | E4970-66520         | 1   | 1    | A20 MOTHERBOARD  | 28480    | E4970-66520     |
| 2           | 04396-61661         | 8   | 2    | CA-ASSY FLAT 100 | 28480    | 04396-61661     |
| 3           | 0515-1550           | 0   | 41   | SCR M3-L 8 P-H   | 28480    | 0515-1550       |

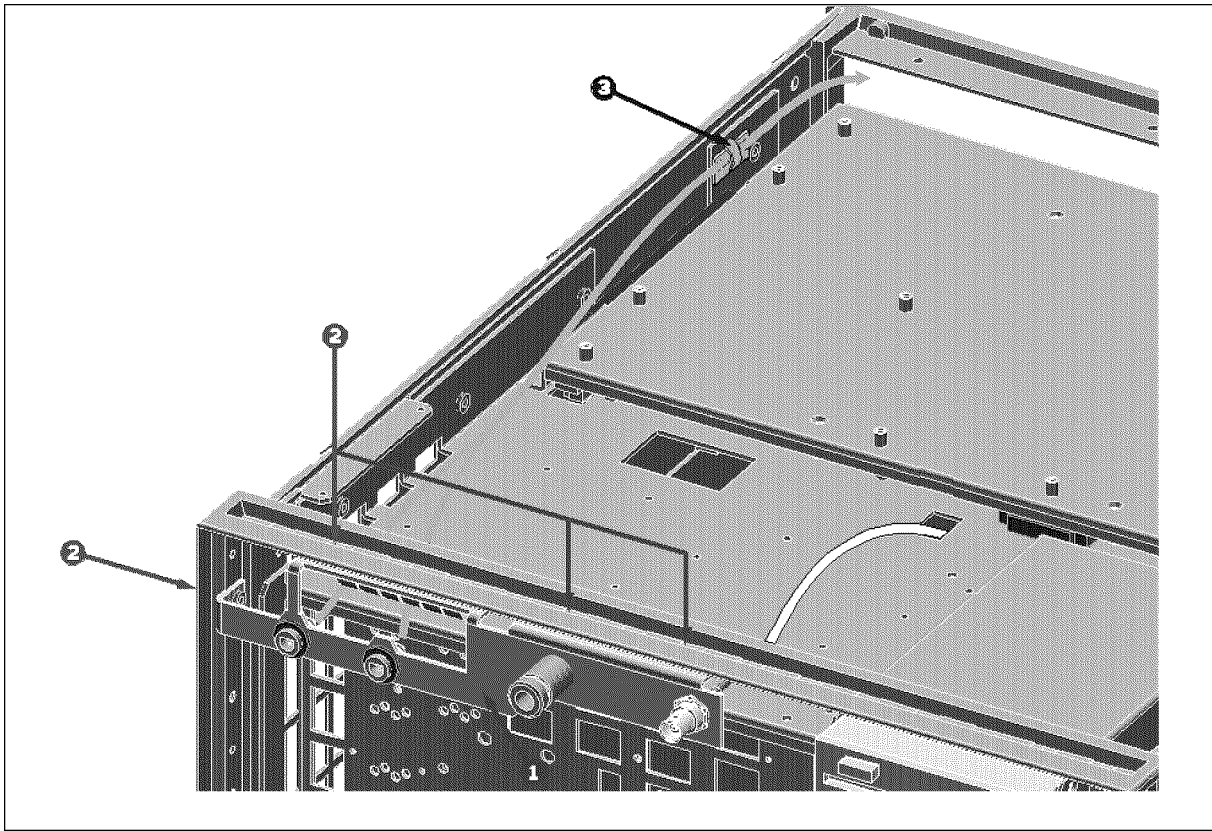


CCS06045

**Figure 10-31. Main Frame Assembly Parts 8/23**

**Table 10-33. Main Frame Assembly Parts 8/23**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description     | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|-----------------|-------------|--------------------|
| 1              | E4970-00103            | 8      | 1    | DECK            | 28480       | E4970-00103        |
| 2              | 0515-0914              | 8      | 31   | SCR-MACH M3X0.5 | 28480       | 0515-0914          |
| 3              | 0515-1550              | 0      | 41   | SCR M3-L 8 P-H  | 28480       | 0515-1550          |

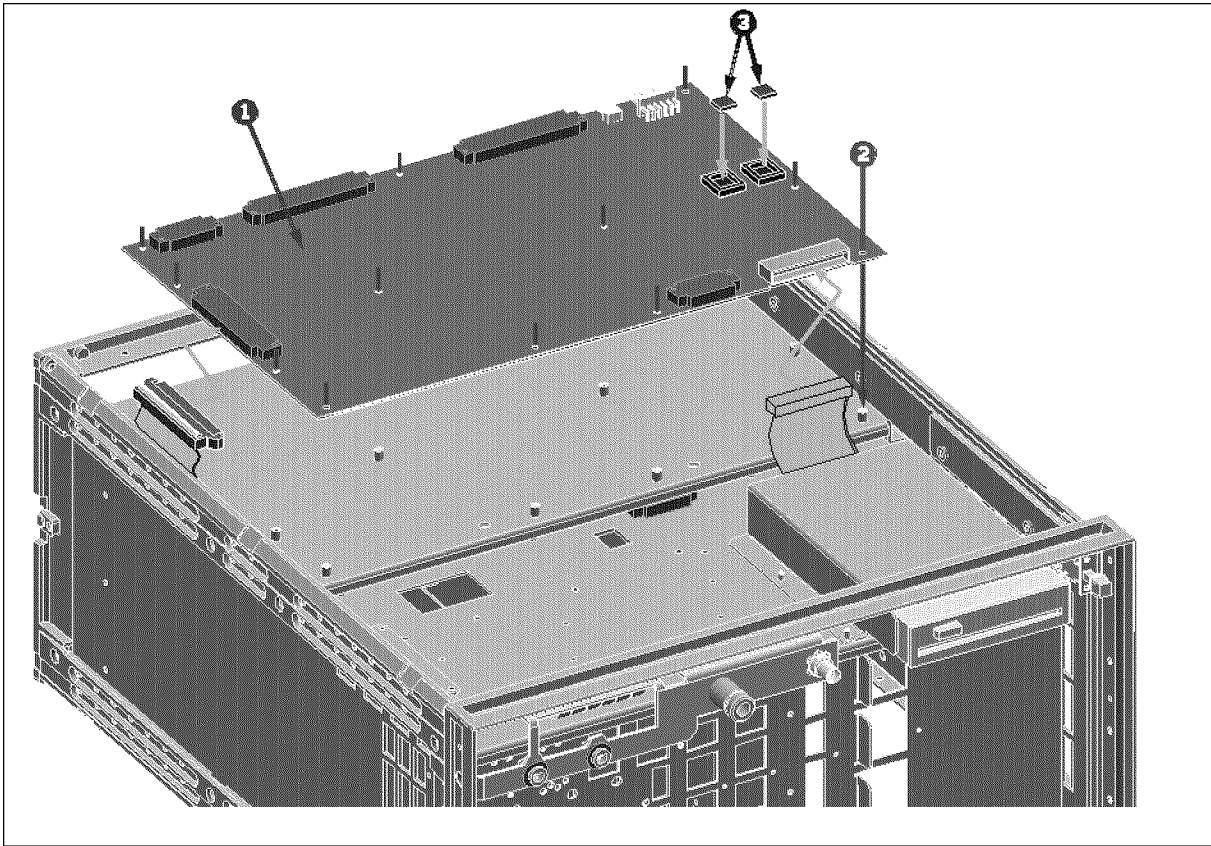


CCS06046

**Figure 10-32. Main Frame Assembly Parts 9/23**

**Table 10-34. Main Frame Assembly Parts 9/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-------------|----------|-----------------|
| 1           | E4970-64903         | 0   | 1    | ANGLE ASSY  | 28480    | E4970-64903     |
| 2           | 0515-1011           | 8   | 4    | SCR FL M4L6 | 28480    | 0515-1011       |
| 3           | 1400-1334           | 6   | 4    | CLAMP CABLE | 28480    | 1400-1334       |



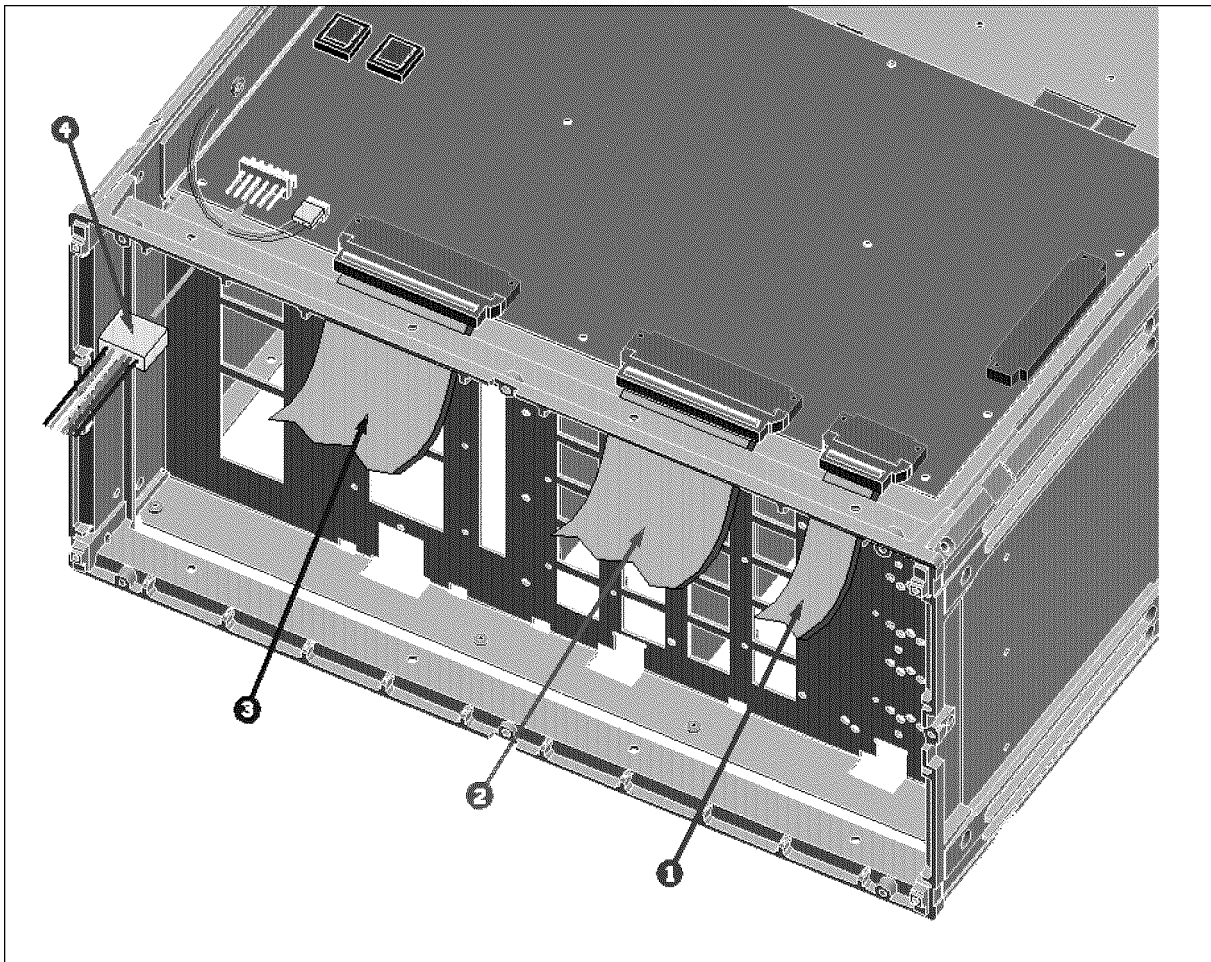
CCS06047

**Figure 10-33. Main Frame Assembly Parts (A1 CPU Board Assembly) 10/23**

**Table 10-35. Main Frame Assembly Parts (A1 CPU Board Assembly) 10/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description    | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|----------------|----------|-----------------|
| 1           | E4970-66501         | 8   | 1    | A1 CPU BOARD   | 28480    | E4970-66501     |
| 2           | 0515-1550           | 0   | 41   | SCR M3-L 8 P-H | 28480    | 0515-1550       |
| 3           | 1818-6574           | 1   | 2    | FLASH ROM      | 28480    | 1818-6574       |



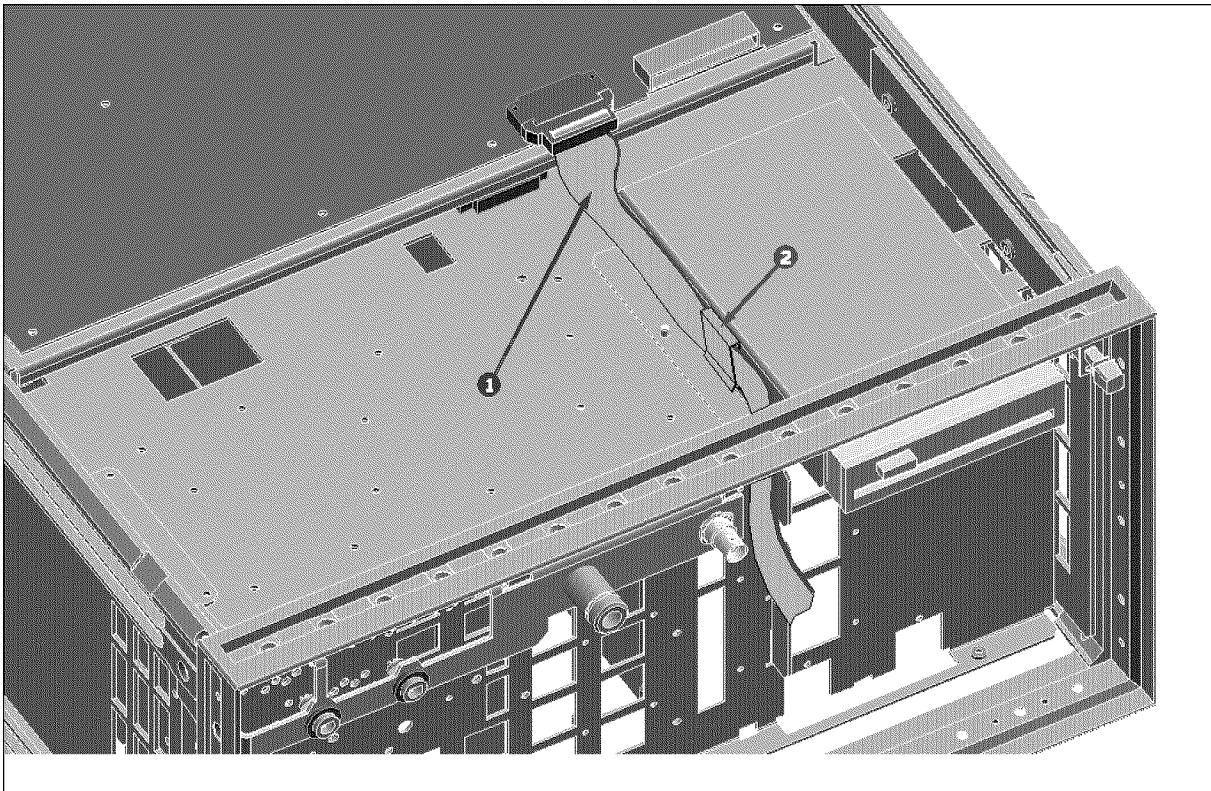


CCS06048

**Figure 10-34. Main Frame Assembly Parts 11/23**

**Table 10-36. Main Frame Assembly Parts 11/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description      | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|------------------|----------|-----------------|
| 1           | 04396-61663         | 0   | 3    | CA-ASSY FLAT 40  | 28480    | 04396-61663     |
| 2           | 04396-61661         | 8   | 2    | CA-ASSY FLAT 100 | 28480    | 04396-61661     |
| 3           | 04396-61707         | 3   | 1    | CABLE ASSY       | 28480    | 04396-61707     |
| 4           | 04396-61671         | 0   | 2    | WIRE ASSY        | 28480    | 04396-61671     |

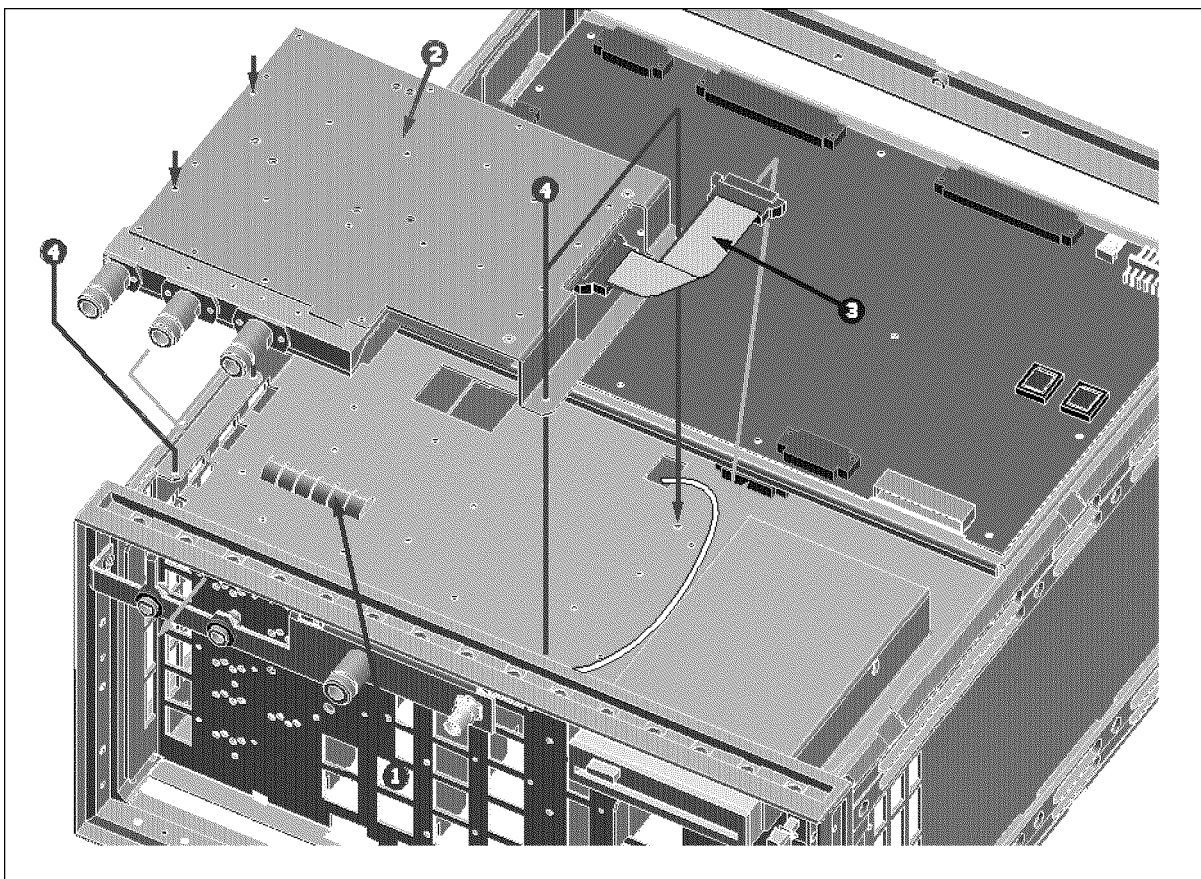


CCS06049

**Figure 10-35. Main Frame Assembly Parts 12/23**

**Table 10-37. Main Frame Assembly Parts 12/23**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description     | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|-----------------|-------------|--------------------|
| 1              | 04396-61662            | 9      | 1    | CA-ASSY FLAT 40 | 28480       | 04396-61662        |
| 2              | 1400-0611              | 0      | 2    | CLAMP-CABLE     | 28480       | 1400-0611          |



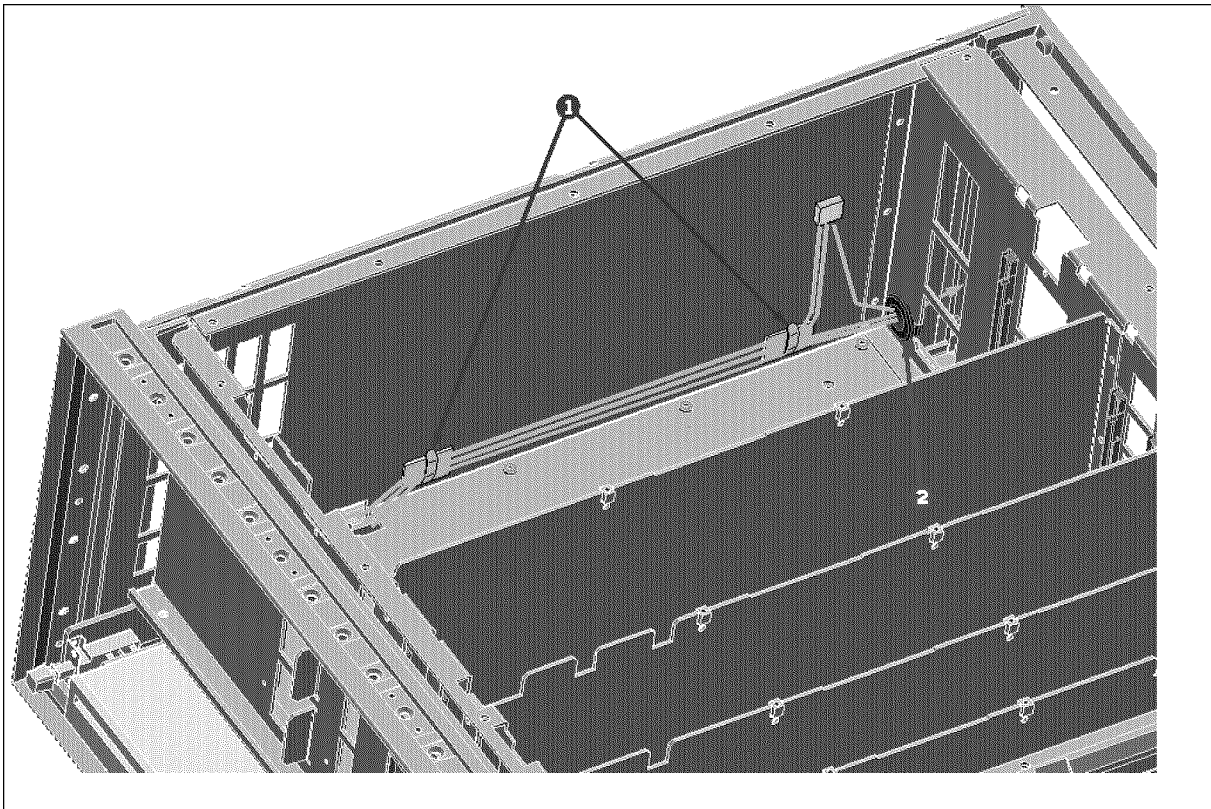
CCS06050

**Figure 10-36. Main Frame Assembly Parts (A9 Input Multiplexer Assembly) 13/23**

**Table 10-38.**  
**Main Frame Assembly Parts (A9 Input Multiplexer Assembly) 13/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description                                | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|--------------------------------------------|----------|-----------------|
| 1           | 8160-0619           | 5   | 0    | SHIELD GASKET                              | 28480    | 8160-0619       |
| 2           | E4970-66509         | 6   | 1    | A9 INPUT MULTIPLEXER                       | 28480    | E4970-66509     |
|             | E4970-69509         |     |      | A9 INPUT MULTIPLEXER<br>(rebuilt-exchange) | 28480    | E4970-69509     |
| 3           | 04396-61663         | 0   | 3    | CA-ASSY FLAT 40                            | 28480    | 04396-61663     |
| 4           | 0515-1550           | 0   | 41   | SCR M3-L 8 P-H                             | 28480    | 0515-1550       |



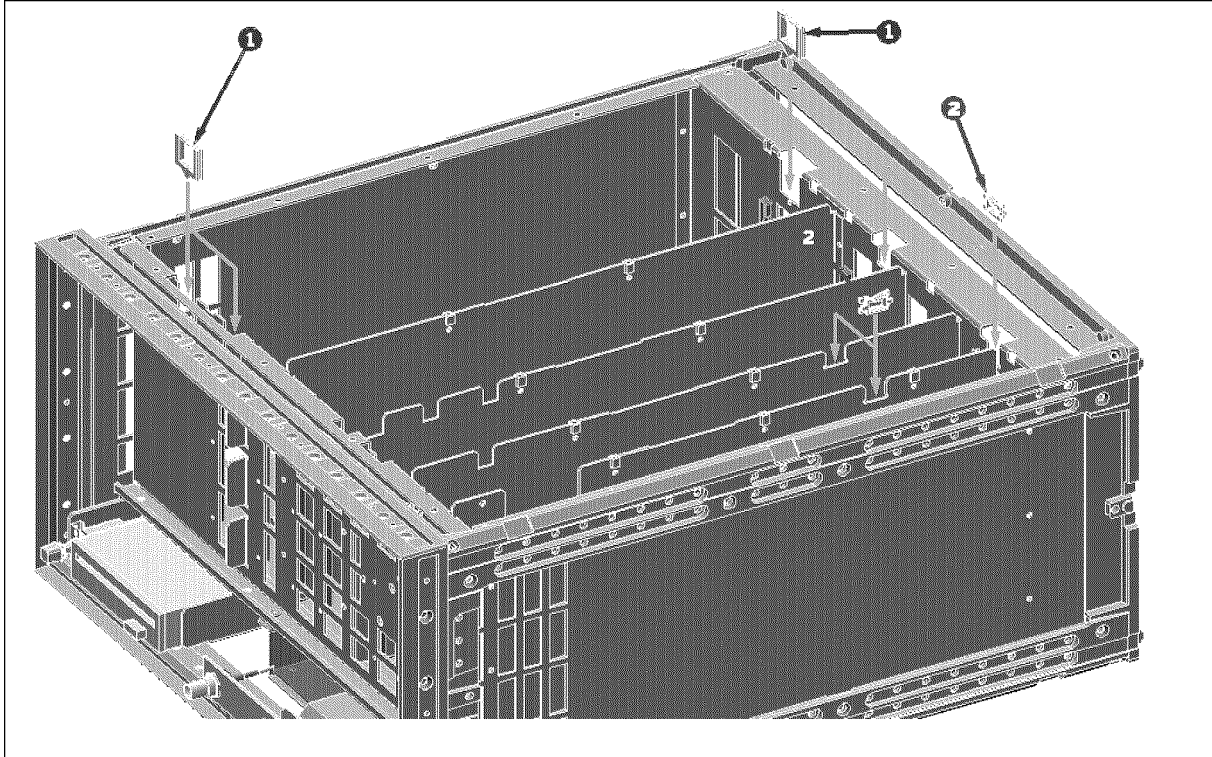


CCS06051

**Figure 10-37. Main Frame Assembly Parts 14/23**

**Table 10-39. Main Frame Assembly Parts 14/23**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|-------------|-------------|--------------------|
| 1              | 1400-1334              | 6      | 4    | CLAMP CABLE | 28480       | 1400-1334          |
| 2              | 0400-0276              | 2      | 1    | GROM RND    | 28480       | 0400-0276          |

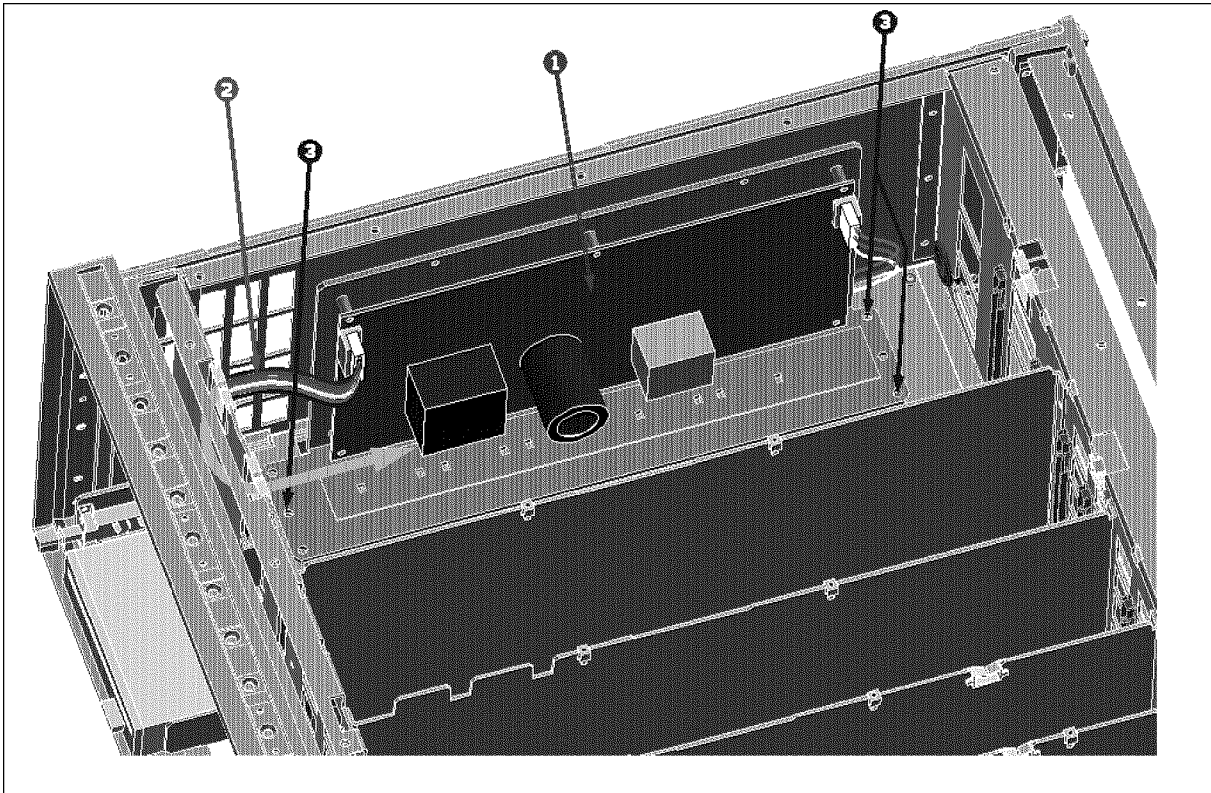


CCS06052

**Figure 10-38. Main Frame Assembly Parts 15/23**

**Table 10-40. Main Frame Assembly Parts 15/23**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|-------------|-------------|--------------------|
| 1              | 1400-2198              | 2      | 3    | SADDLE-EDGE | 28480       | 1400-2198          |
| 2              | 1400-1048              | 9      | 4    | SADDLE-EDGE | 28480       | 1400-1048          |

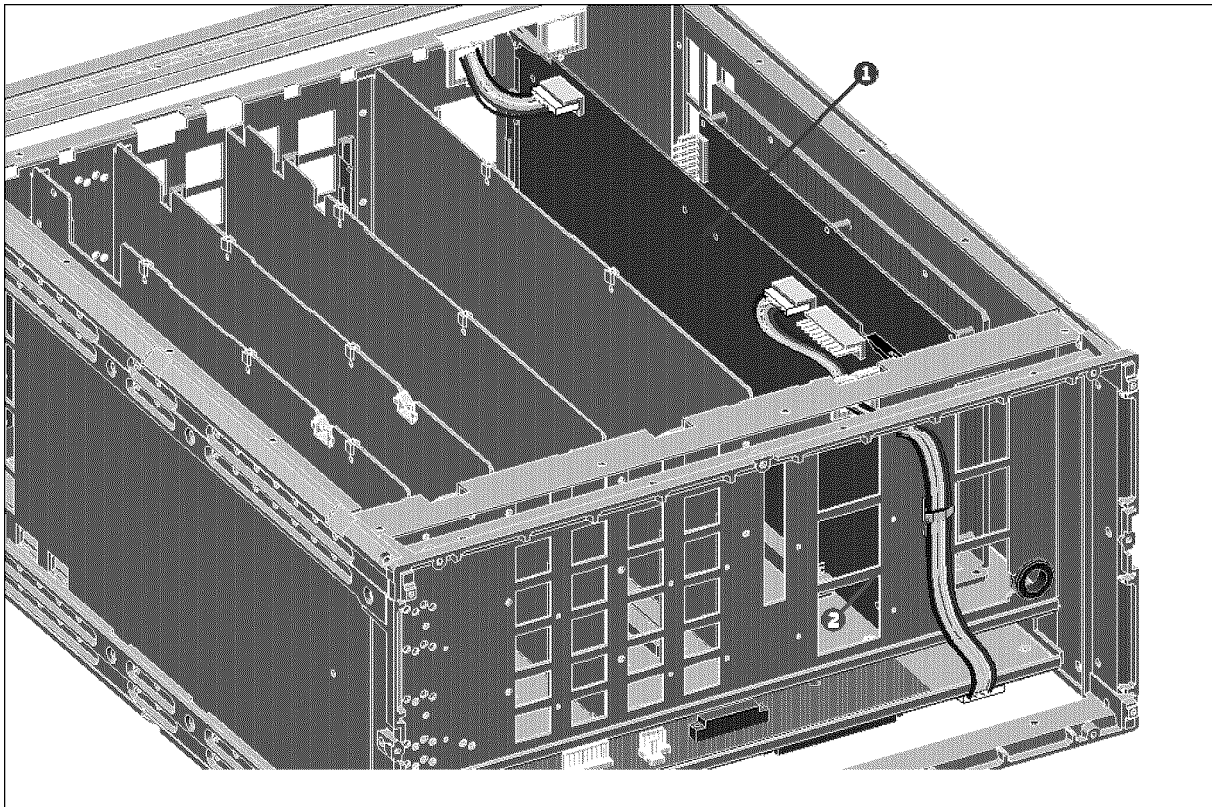


CCS06053

**Figure 10-39. Main Frame Assembly Parts (Pre-regulator Assembly) 16/23**

**Table 10-41. Main Frame Assembly Parts (Pre-regulator Assembly) 16/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description       | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-------------------|----------|-----------------|
| 1           | 0950-3246           | 7   | 1    | A40 PRE-REGULATOR | 28480    | 0950-3246       |
| 2           | 04396-61671         | 0   | 2    | WIRE ASSY         | 28480    | 04396-61671     |
| 3           | 0515-1719           | 3   | 25   | SCR M4X10         | 28480    | 0515-1719       |

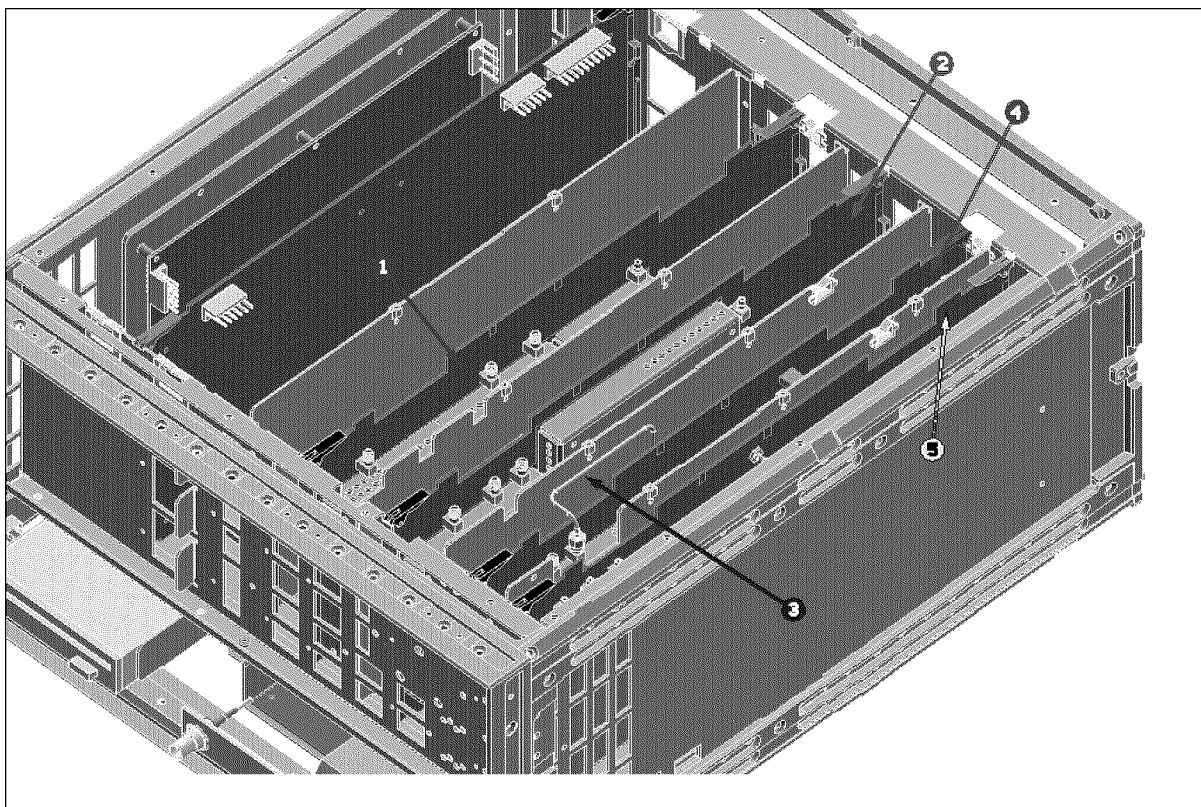


CCS06054

**Figure 10-40. Main Frame Assembly Parts (A50 DC-DC Converter Assembly) 17/23**

**Table 10-42.  
Main Frame Assembly Parts (A50 DC-DC Converter Assembly) 17/23**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description         | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|---------------------|-------------|--------------------|
| 1              | E4970-66550            | 7      | 1    | A50 DC-DC CONVERTER | 28480       | E4970-66550        |
| 2              | 1400-1391              | 5      | 4    | CLAMP CABLE         | 28480       | 1400-1391          |



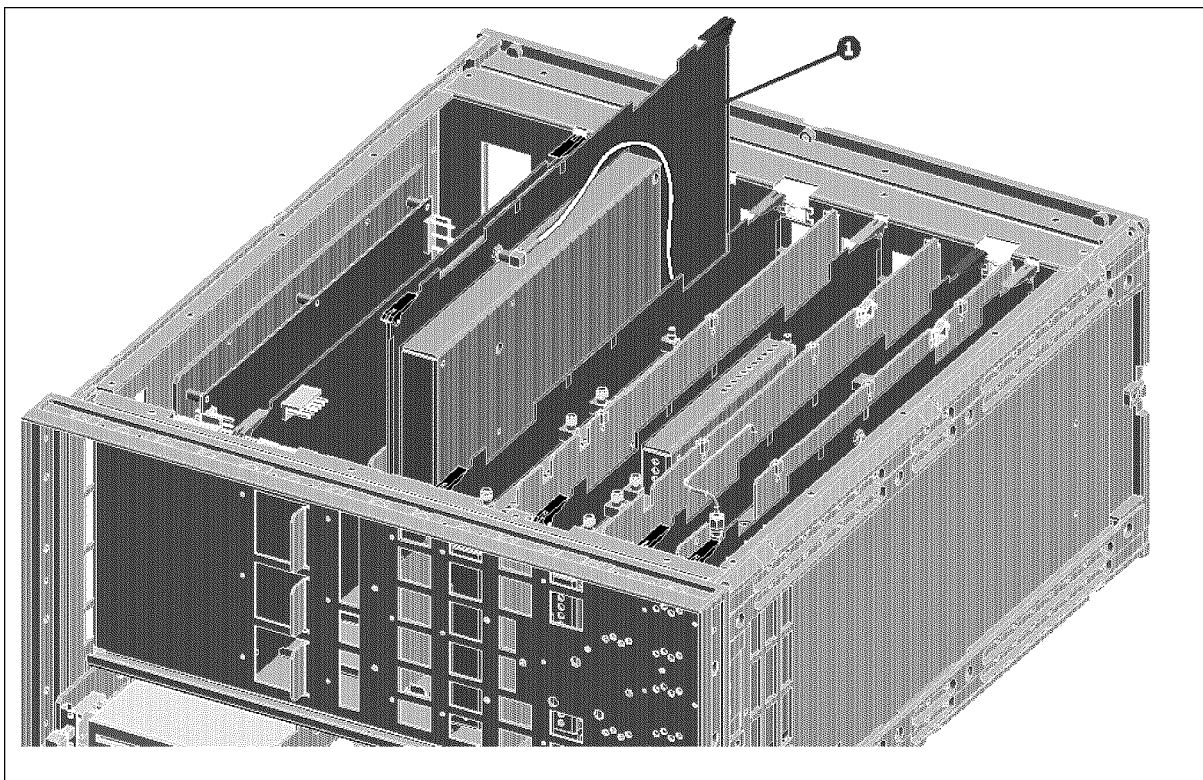
CCS06055

**Figure 10-41. Main Frame Assembly Parts (A5 and A7 Assemblies) 18/23**

**Table 10-43. Main Frame Assembly Parts (A5 and A7 Assemblies) 18/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description                                | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|--------------------------------------------|----------|-----------------|
| 1           | E4970-66503         | 0   | 1    | TRACKING SOURCE                            | 28480    | E4970-66503     |
| 2           | E4970-66515         | 4   | 1    | A5 LOCAL SYNTHESIZER                       | 28480    | E4970-66515     |
|             | E4970-69515         |     |      | A5 LOCAL SYNTHESIZER<br>(rebuilt-exchange) | 28480    | E4970-69515     |
| 3           | E4970-61615         | 5   | 1    | RF CBL ASSY                                | 28480    | E4970-61615     |
| 4           | E4970-66507         | 4   | 1    | A7 FREQ. CONVERTER                         | 28480    | E4970-66507     |
|             | E4970-69507         |     |      | A7 FREQ. CONVERTER<br>(rebuilt-exchange)   | 28480    | E4970-69507     |
| 5           | E4970-66508         | 5   | 1    | DIGITAL IF                                 | 28480    | E4970-66508     |



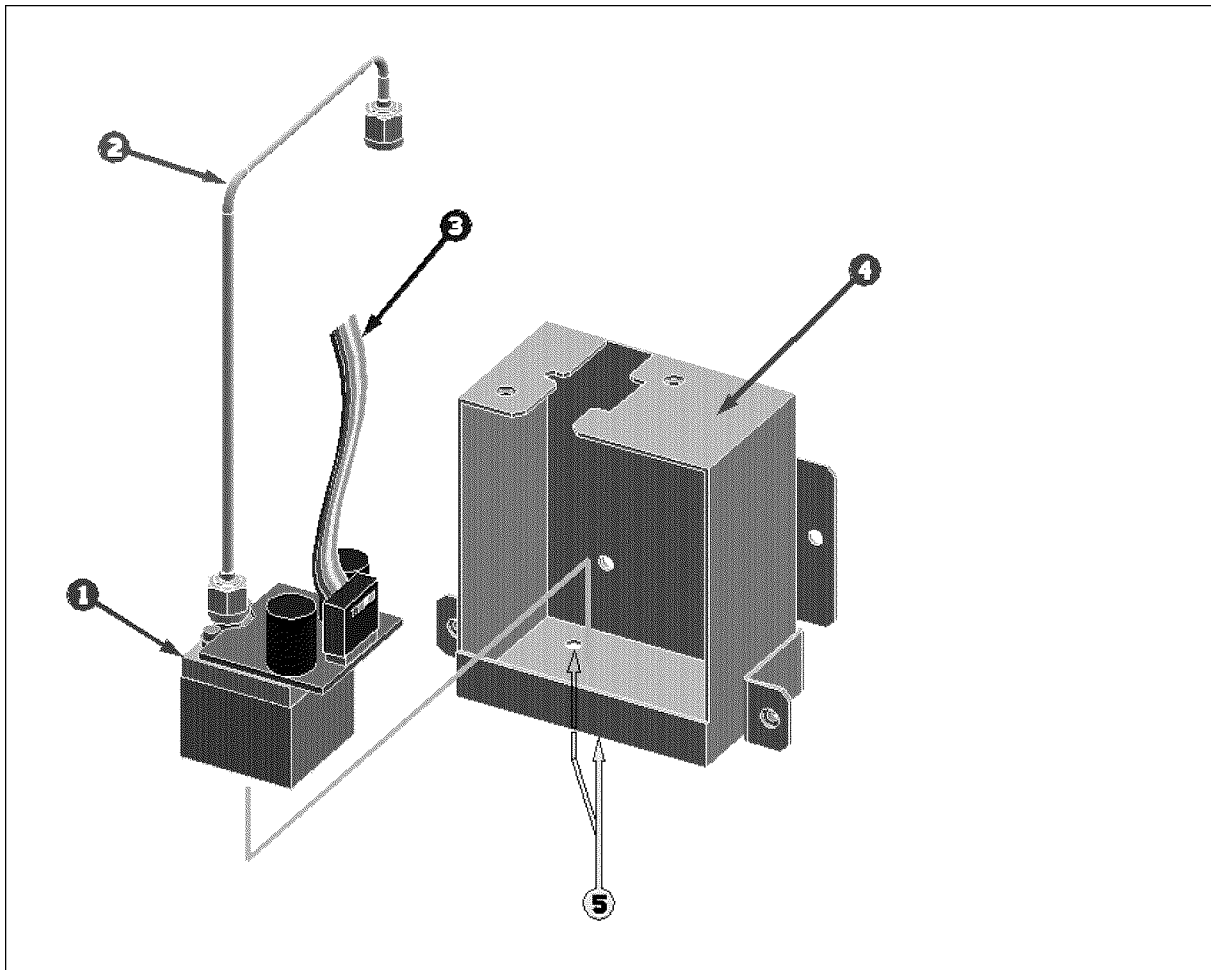


CCS06056

**Figure 10-42. Main Frame Assembly Parts (A2 DC Bias Assembly) 19/23**

**Table 10-44. Main Frame Assembly Parts (A2 DC Bias Assembly) 19/23**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description                | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|----------------------------|-------------|--------------------|
| 1              | E4970-66502            | 9      |      | A2 DC BIAS ASSY (Opt. 001) | 28480       | E4970-66502        |

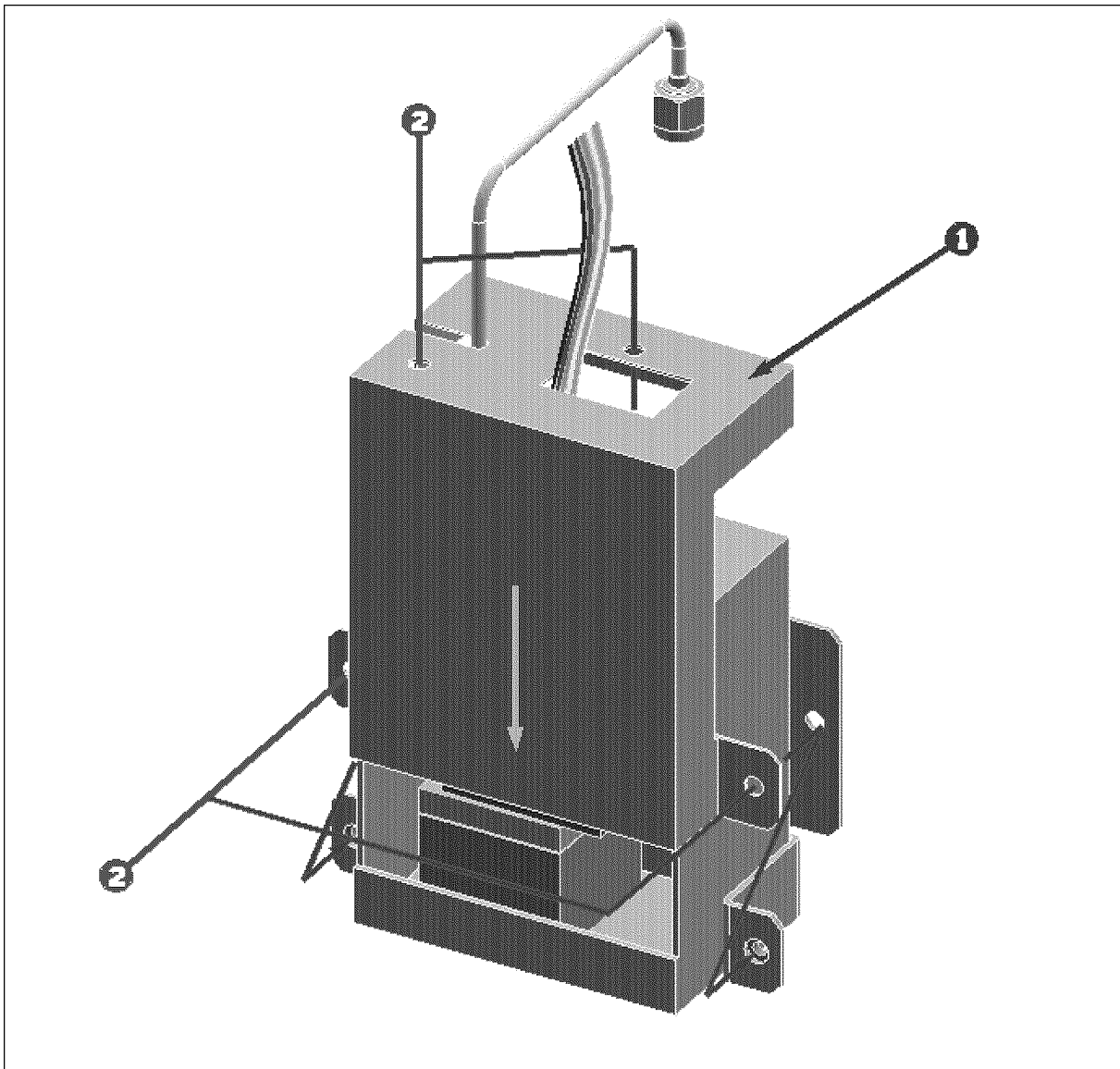


CCS06057

**Figure 10-43. Main Frame Assembly Parts (YTO Assembly) 20/23**

**Table 10-45. Main Frame Assembly Parts (YTO Assembly) 20/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description   | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|---------------|----------|-----------------|
| 1           | E4970-61002         | 4   | 1    | YTO ASSY      | 28480    | E4970-61002     |
| 2           | E4970-61613         | 3   | 1    | RF CBL ASSY   | 28480    | E4970-61613     |
| 3           | E4970-61617         | 2   | 1    | CABLE ASSY    | 28480    | E4970-61617     |
| 4           | E4970-00626         | 0   | 1    | CASE SHIELD   | 28480    | E4970-00626     |
| 5           | 2200-0101           | 0   | 2    | SCR-MACH 4-40 | 28480    | 2200-0101       |



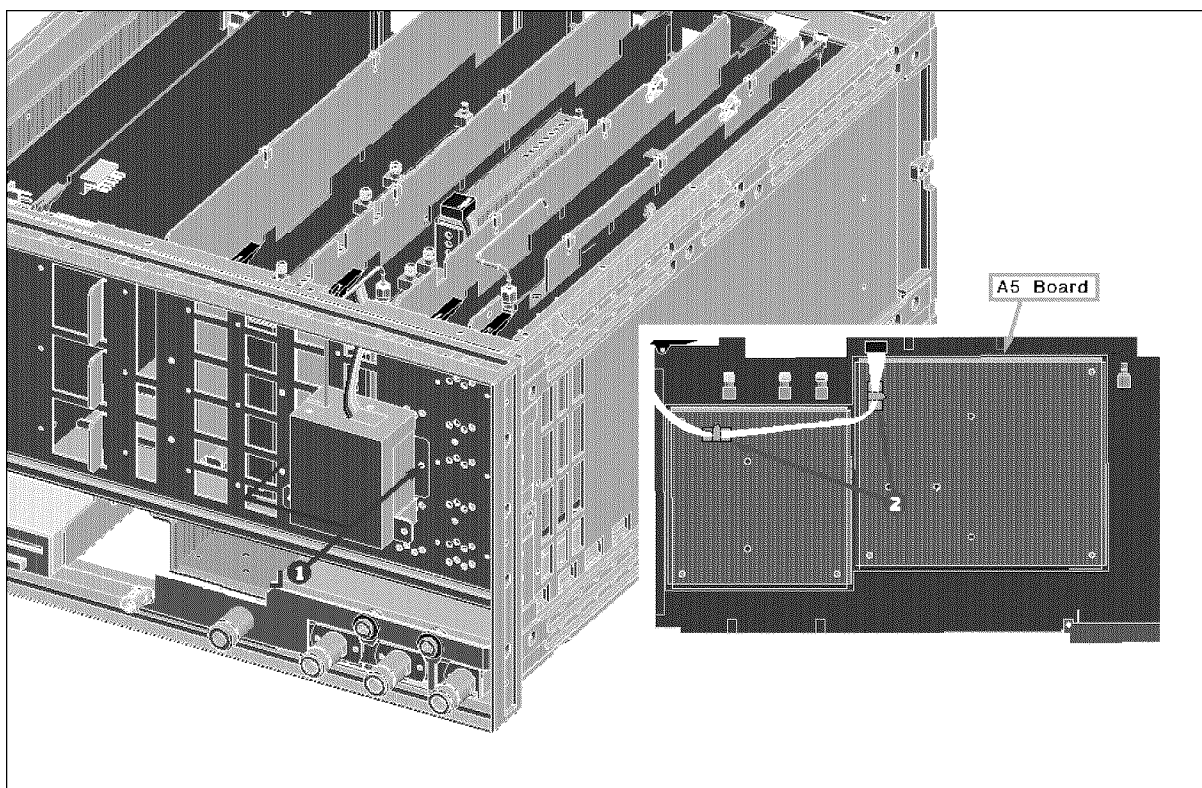
CCS06058

**Figure 10-44. Main Frame Assembly Parts (YTO Assembly) 21/23**

**Table 10-46. Main Frame Assembly Parts (YTO Assembly) 21/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description    | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|----------------|----------|-----------------|
| 1           | E4970-00625         | 9   | 1    | CASE SHIELD    | 28480    | E4970-00625     |
| 2           | 0515-1550           | 0   | 41   | SCR M3-L 8 P-H | 28480    | 0515-1550       |



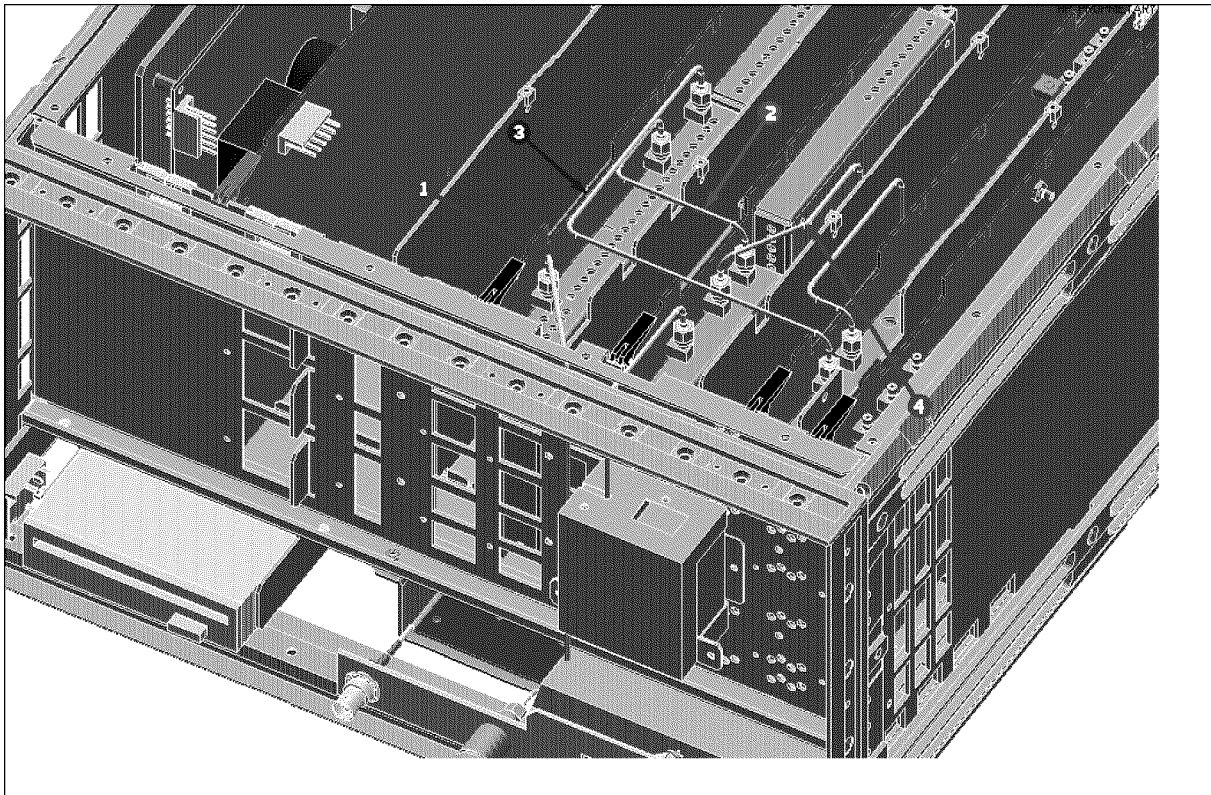


CCS06059

**Figure 10-45. Main Frame Assembly Parts (YTO Assembly) 22/23**

**Table 10-47. Main Frame Assembly Parts (YTO Assembly) 22/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description    | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|----------------|----------|-----------------|
| 1           | 0515-1550           | 0   | 16   | SCR M3-L 8 P-H | 28480    | 0515-1550       |
| 2           | 1400-1391           | 5   | 4    | CLAMP CABLE    | 28480    | 1400-1391       |



CCS06060

**Figure 10-46. Main Frame Assembly Parts 23/23**

**Table 10-48. Main Frame Assembly Parts 23/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-------------|----------|-----------------|
| 1           | E4970-61616         | 6   | 1    | RF CBL ASSY | 28480    | E4970-61616     |
| 2           | E4970-61614         | 4   | 1    | RF CBL ASSY | 28480    | E4970-61614     |
| 3           | E4970-61612         | 2   | 1    | RF CBL ASSY | 28480    | E4970-61612     |
| 4           | E4970-61611         | 1   | 1    | RF CBL ASSY | 28480    | E4970-61611     |

## Post Repair Procedures

### INTRODUCTION

This chapter lists the procedures required to verify the analyzer operation after an assembly is replaced with a new one.

### POST REPAIR PROCEDURES

Table 11-1 *Post Repair Procedures* lists the required procedures that must be performed after the replacement of an assembly or the EEPROM. These are the recommended minimum procedures to ensure that the analyzer is working properly following the replacement.

When you replace an assembly or the EEPROM on the A1 CPU, perform the adjustments and updating correction constants listed in Table 11-1. Then perform the operational verifications and performance verifications listed in Table 11-1.

For the detailed procedure of the adjustments and updating correction constants, see the *Adjustments* chapter. For the detailed operational verification procedures, see this manual's chapter specified in Table 11-1. For the detailed performance verification procedures, see the *Performance Tests* chapter.

**Table 11-1. Post Repair Procedures**

| Replaced Assembly or Part | Adjustments<br>Correction Constants                                                                                                                                                                                                                                                | Verification                                                                                          |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| A1 CPU                    | Firmware Installation. <sup>1</sup>                                                                                                                                                                                                                                                | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>2</sup><br>Internal Test 2: A1 VOLATILE MEMORY <sup>2</sup> |
| A1 EEPROM                 | Local DAC Adjustment<br>Source Power Adjustment<br>Source Flatness Adjustment<br>IF 8 dB/16 dB Gain Adjustment<br>IF Gain Error CC<br>Temperature Adjustment<br>Receiver Flatness Adjustment<br>Receiver Attenuator Adjustment<br>IF BPF Flatness Adjustment<br>DC Bias Adjustment | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>2</sup><br>All Performance Test Items                       |

<sup>1</sup> See the *Digital Control Troubleshooting* chapter.

<sup>2</sup> See the *Troubleshooting* chapter.

**Table 11-1. Post Repair Procedures (continued)**

| Replaced Assembly or Part | Adjustments<br>Correction Constants                                                                                                                                                                                                                                                                 | Verification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A2 DC Bias                | DC Bias Adjustment                                                                                                                                                                                                                                                                                  | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br>DC Bias Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| A3 Tracking Source        | Local DAC Adjustment<br>Source Flatness Adjustment                                                                                                                                                                                                                                                  | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br>Frequency Accuracy<br>Source Level/Flatness<br>Non-sweep Linearity<br>Power Sweep Linearity<br>Harmonics/Non-harmonic<br>Input Crosstalk<br>Input Impedance                                                                                                                                                                                                                                                                                                                                                                                                            |
| A5 Local Synthesizer      | Local DAC Adjustment<br>Source Power Adjustment<br>Source Flatness Adjustment<br>Input Local Null Adjustment<br>Receiver Gain Adjustment<br>IF 8 dB/16 dB Gain Adjustment<br>Temperature Adjustment<br>Receiver Flatness Adjustment<br>Receiver Attenuator Adjustment<br>IF BPF Flatness Adjustment | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br>Frequency Accuracy<br>Source Level/Flatness<br>Non-sweep Linearity<br>Power Sweep Linearity<br>Harmonics/Non-harmonic<br>Receiver Noise Level<br>Input Crosstalk<br>Absolute Amplitude Accuracy<br>Magnitude Ratio/Phase Dynamic Accuracy<br>Magnitude Ratio/Phase Frequency Response<br>Displayed Average Noise Level<br>Amplitude Fidelity<br>Input Attenuator Switching Uncertainty<br>Noise Sidebands Test<br>Amplitude Accuracy/Frequency Response<br>Second Harmonic Distortion<br>Third Order Intermodulation Distortion<br>Other Spurious<br>Residual Response |

<sup>1</sup> See the *Troubleshooting* chapter.

**Table 11-1. Post Repair Procedures (continued)**

| Replaced Assembly or Part | Adjustments<br>Correction Constants                                                                                                                                                                                                                  | Verification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A7 Freq. Converter        | Frequency Reference Adjustment<br>Source Power Adjustment<br>Source Flatness Adjustment<br>Receiver Gain Adjustment<br>IF 8 dB/16 dB Gain Adjustment<br>Receiver Flatness Adjustment<br>Receiver Attenuator Adjustment<br>IF BPF Flatness Adjustment | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br>Frequency Accuracy<br>Source Level/Flatness<br>Non-sweep Linearity<br>Power Sweep Linearity<br>Harmonics/Non-harmonic<br>Receiver Noise Level<br>Absolute Amplitude Accuracy<br>Magnitude Ratio/Phase Dynamic Accuracy<br>Magnitude Ratio/Phase Frequency Response<br>Displayed Average Noise Level<br>Amplitude Fidelity<br>Input Attenuator Switching Uncertainty<br>Noise Sidebands Test<br>Amplitude Accuracy/Frequency Response<br>Second Harmonic Distortion<br>Third Order Intermodulation Distortion<br>Other Spurious<br>Residual Response |
| A8 Digital IF             | IF 24 dB Gain/Phase Adjustment<br>Receiver Gain Adjustment<br>IF 8 dB/16 dB Gain Adjustment<br>Receiver Flatness Adjustment<br>Receiver Attenuator Adjustment<br>IF BPF Flatness Adjustment                                                          | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br>Receiver Noise Level<br>Absolute Amplitude Accuracy<br>Magnitude Ratio/Phase Dynamic Accuracy<br>Magnitude Ratio/Phase Frequency Response<br>Displayed Average Noise Level<br>Amplitude Fidelity<br>Input Attenuator Switching Uncertainty<br>Noise Sidebands Test<br>Amplitude Accuracy/Frequency Response<br>Third Order Intermodulation Distortion<br>Other Spurious<br>Residual Response                                                                                                                                                        |

<sup>1</sup> See the *Troubleshooting* chapter.

**Table 11-1. Post Repair Procedures (continued)**

| Replaced Assembly or Part | Adjustments<br>Correction Constants                                                                                                                                                                                    | Verification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A9 Input Multiplexer      | Input DC Offset Adjustment<br>Input Local Null Adjustment<br>Receiver Gain Adjustment<br>IF 8 dB/16 dB Gain Adjustment<br>Receiver Flatness Adjustment<br>Receiver Attenuator Adjustment<br>IF BPF Flatness Adjustment | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br>Receiver Noise Level<br>Input Crosstalk<br>Input Impedance<br>Absolute Amplitude Accuracy<br>Magnitude Ratio/Phase Dynamic Accuracy<br>Magnitude Ratio/Phase Frequency Response<br>Displayed Average Noise Level<br>Amplitude Fidelity<br>Input Attenuator Switching Uncertainty<br>Amplitude Accuracy/Frequency Response<br>Second Harmonic Distortion<br>Third Order Intermodulation Distortion<br>Other Spurious<br>Residual Response |
| A20 Mother Board          | None                                                                                                                                                                                                                   | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| A30 Front Keyboard        | None                                                                                                                                                                                                                   | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br><i>External Test 50: FRONT PANEL DIAG</i> <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                   |
| A32 IBASIC I/F            | None                                                                                                                                                                                                                   | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br><i>Check the A32 I-BASIC Interface and the mini DIN Keyboard</i> <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                            |
| A33 EXT I/O               | None                                                                                                                                                                                                                   | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br><i>External Test 52: 24 BIT I/O PORT</i> <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                    |
| A40 Pre-Regulator         | DC Bias Adjustment                                                                                                                                                                                                     | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| A50 DC-DC Converter       | None                                                                                                                                                                                                                   | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| A51 GSP                   | None                                                                                                                                                                                                                   | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| A52 LCD                   | None                                                                                                                                                                                                                   | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| A53 FDD                   | None                                                                                                                                                                                                                   | <i>INSPECT THE POWER ON SEQUENCE</i> <sup>1</sup><br><i>External Test 51: DSK DR FAULTY ISOLN</i> <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                |

<sup>1</sup> See the *Troubleshooting* chapter.

<sup>2</sup> See the *Digital Control Troubleshooting* chapter.

## Manual Changes

---

### Introduction

This appendix contains the information required to adapt this manual to earlier versions or configurations of the analyzer than the current printing date of this manual. The information in this manual applies directly to the 4395A Network/Spectrum/Impedance Analyzer serial number prefix listed on the title page of this manual.

---

### Manual Changes

To adapt this manual to your 4395A, see Table A-1 and Table A-2, and make all the manual changes listed opposite your instrument's serial number and firmware version.

Instruments manufactured after the printing of this manual may be different from those documented in this manual. Later instrument versions will be documented in a manual changes supplement that will accompany the manual shipped with that instrument. If your instrument's serial number is not listed on the title page of this manual or in Table A-1, it may be documented in a *yellow MANUAL CHANGES* supplement.

In additions to change information, the supplement may contain information for correcting errors (Errata) in the manual. To keep this manual as current and accurate as possible, Agilent Technologies recommends that you periodically request the latest *MANUAL CHANGES* supplement.

For information concerning serial number prefixes not listed on the title page or in the *MANUAL CHANGE* supplement, contact the nearest Agilent Technologies office.

Turn on the line switch or execute the \*IDN? command by GPIB to confirm the firmware version. See the *GPIB Command Reference* manual for information on the \*IDN? command.

**Table A-1. Manual Changes by Serial Number**

| Serial Prefix or Number                    | Make Manual Changes |
|--------------------------------------------|---------------------|
| JP1KE00275 or below                        | Change 1            |
| JP1KE00413 or below                        | Change 2            |
| JP1KE00536 or below                        | Change 3            |
| JP1KE01646 or below                        | Change 4            |
| from JP1KE00276 to<br>JP1KE002173          | Change 5            |
| JPIKE02196 or below<br>MY41100219 or below | Change 6            |

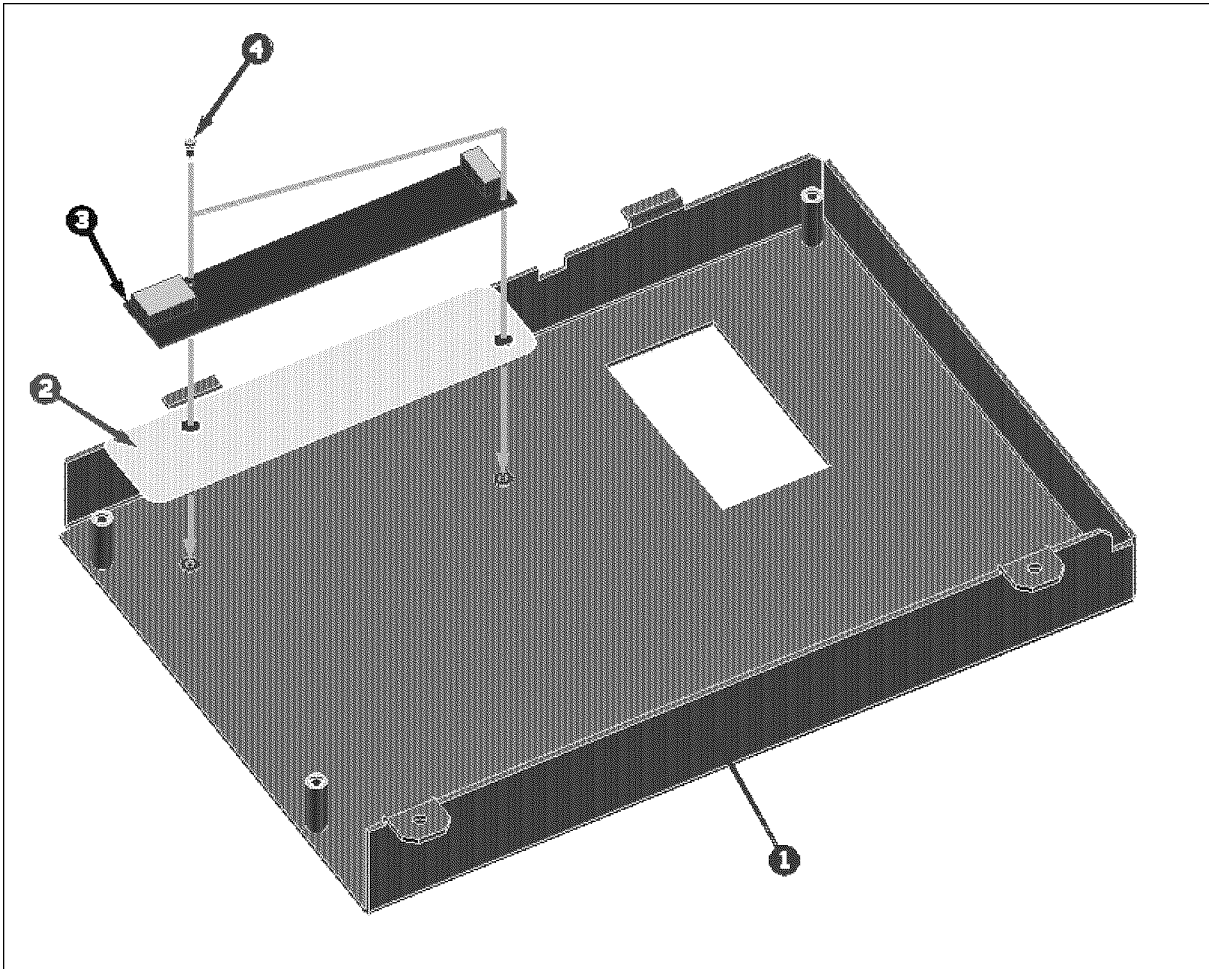
**Table A-2. Manual Changes by Firmware Version**

| Version | Make Manual Changes |
|---------|---------------------|
|         |                     |



## Change 1

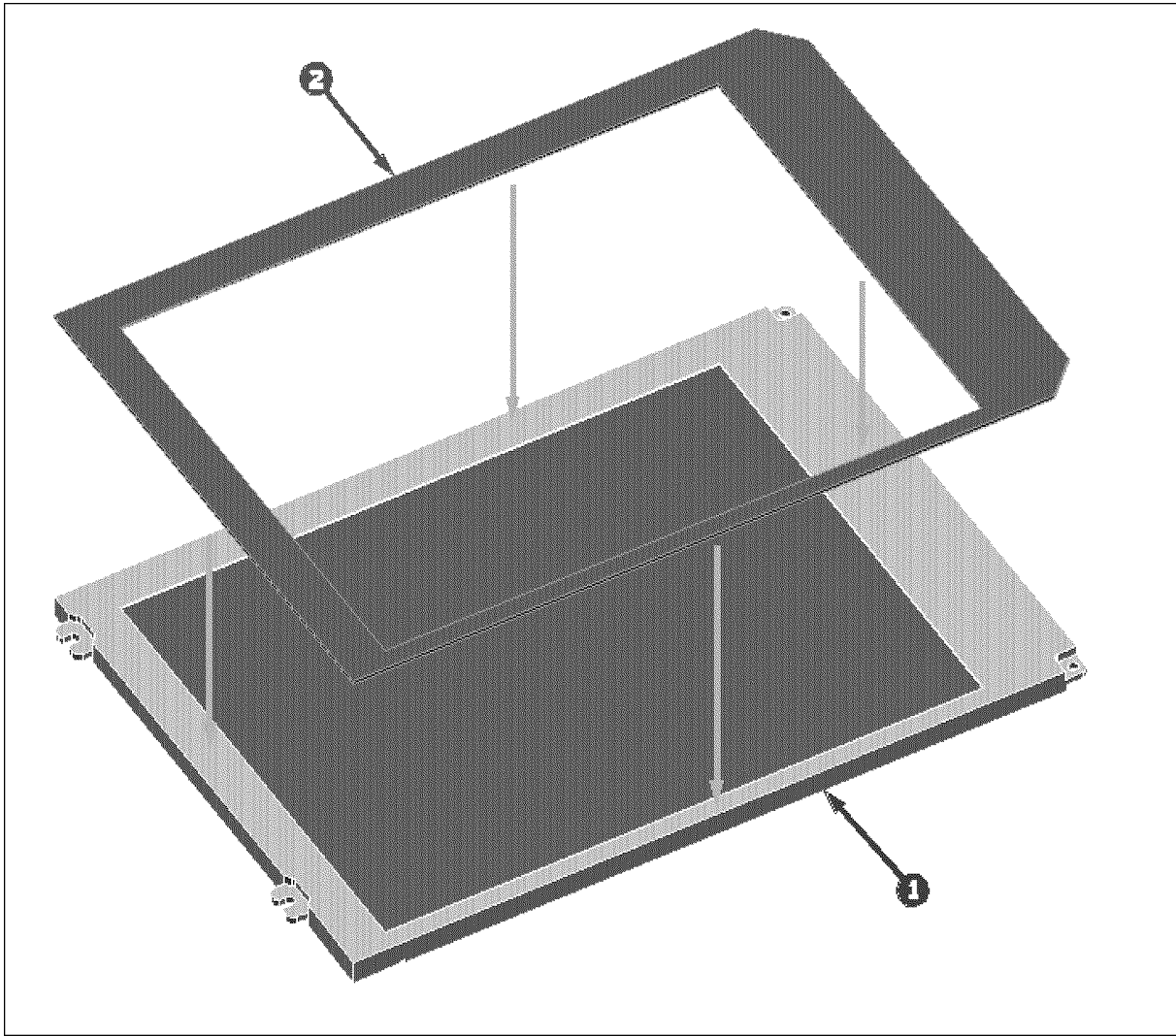
Change the Replaceable Parts as following.



**Figure A-1. Front Assembly Parts 3/7**

**Table A-3. Front Assembly Parts 3/7**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description       | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-------------------|----------|-----------------|
| 1           | E4970-04001         | 3   | 1    | COVER             | 28480    | E4970-04001     |
| 2           | E4970-25001         | 7   | 1    | FILTER            | 28480    | E4970-25001     |
| 3           | 0950-2924           | 6   | 1    | A54 INVERTER CCFT | 28480    | 0950-2924       |
| 4           | 0515-0977           | 3   | 2    | SCR-MACH M2X0.4   | 28480    | 0515-0977       |

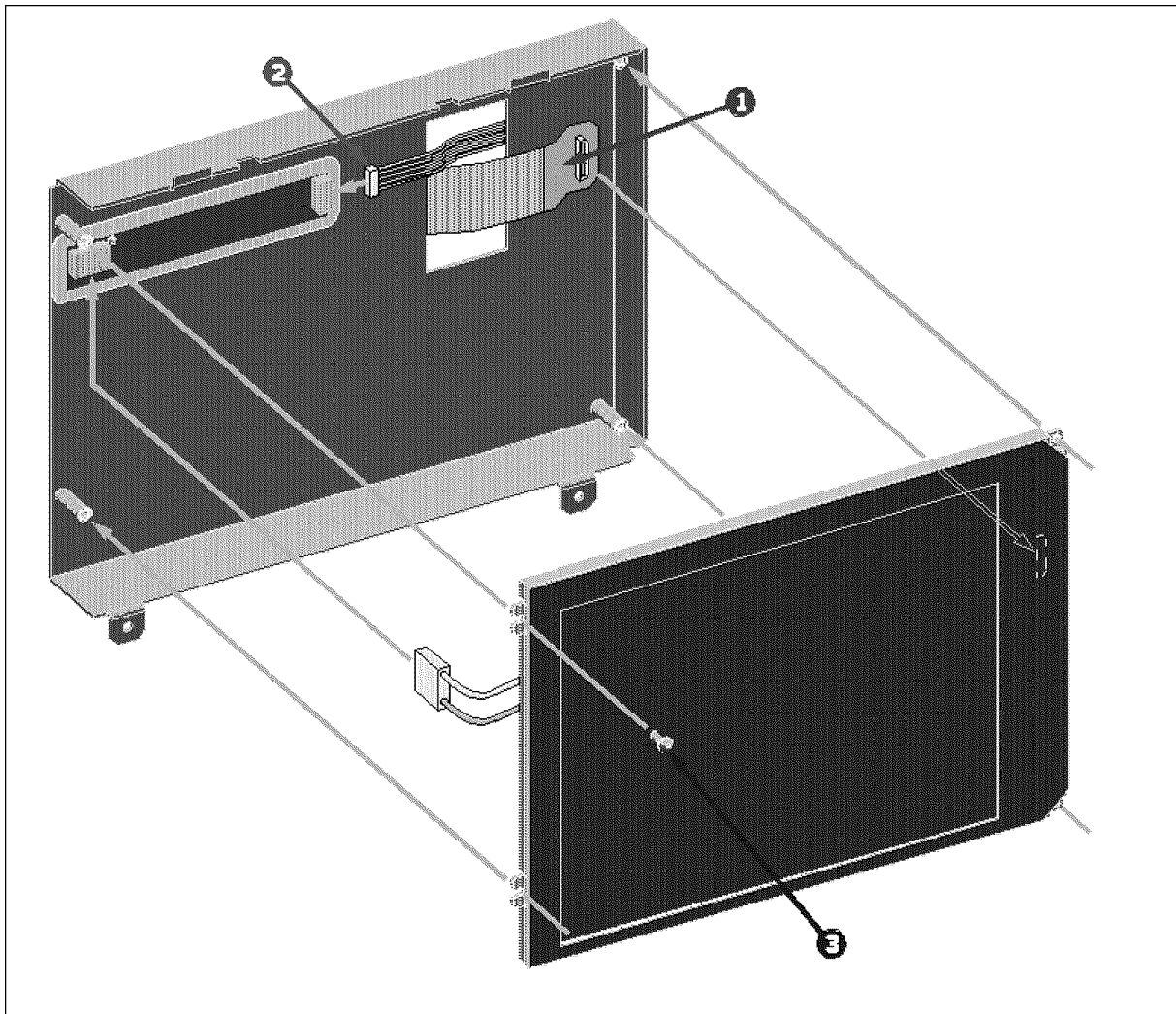


CCS06026

**Figure A-2. Front Assembly Parts 4/7**

**Table A-4. Front Assembly Parts 4/7**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description   | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|---------------|-------------|--------------------|
| 1              | 2090-0534              | 8      | 1    | A52 LCD 8.5IN | 28480       | 2090-0534          |
| 2              | 04396-25071            | 8      | 1    | GASKET        | 28480       | 04396-25071        |

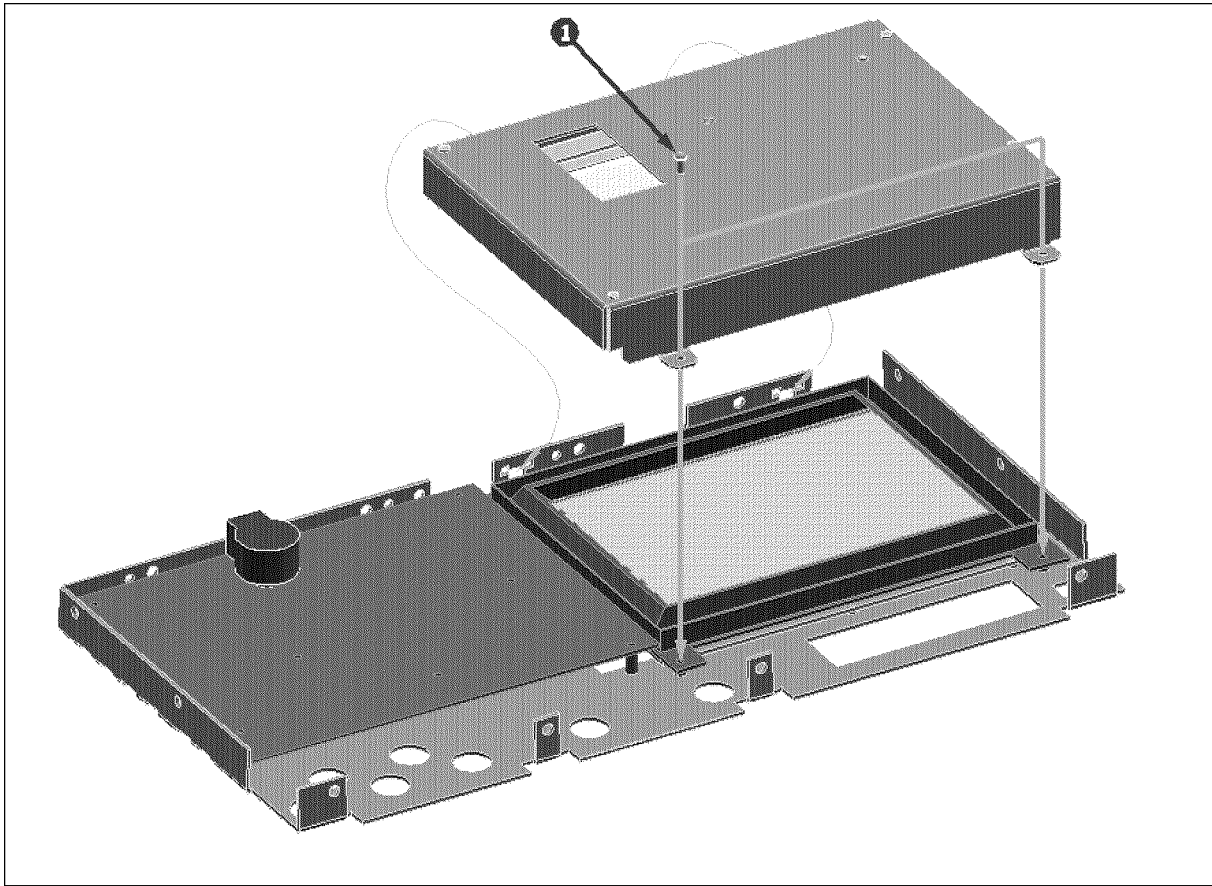


CCS06027

**Figure A-3. Front Assembly Parts 5/7**

**Table A-5. Front Assembly Parts 5/7**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description    | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|----------------|-------------|--------------------|
| 1              | 04396-61708            | 4      | 1    | FLEX PCBD ASSY | 28480       | 04396-61708        |
| 2              | 04396-61709            | 5      | 1    | CABLE ASSY     | 28480       | 04396-61709        |
| 3              | 0515-1550              | 0      | 16   | SCR M3-L 8 P-H | 28480       | 0515-1550          |



CCS06028

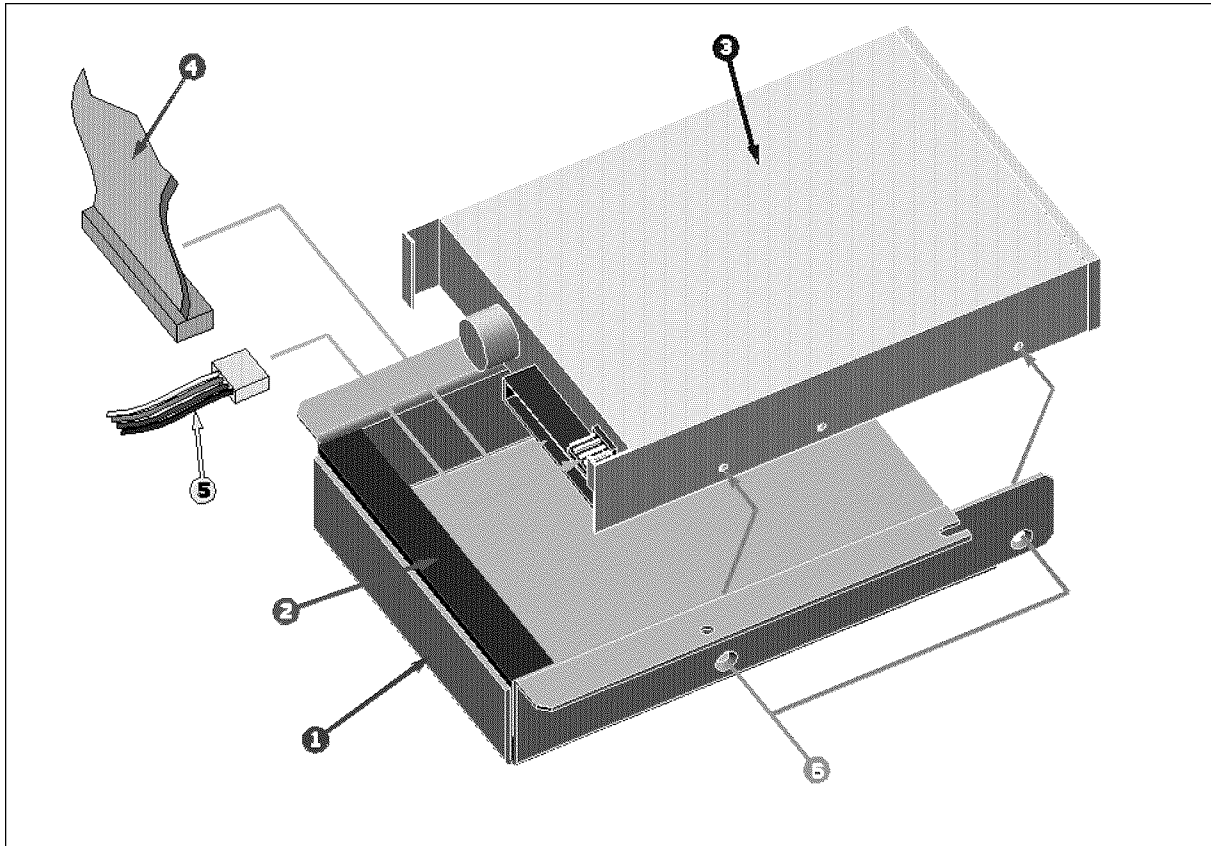
**Figure A-4. Front Assembly Parts 6/7**

**Table A-6. Front Assembly Parts 6/7**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description    | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|----------------|-------------|--------------------|
| 1              | 0515-1550              | 0      | 3    | SCR M3-L 8 P-H | 28480       | 0515-1550          |

## Change 2

Change the Replaceable Parts as following.



CCS06040

**Figure A-5. Main Frame Assembly Parts (FDD Assembly) 3/23**

**Table A-7. Main Frame Assembly Parts (FDD Assembly) 3/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description     | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-----------------|----------|-----------------|
| 1           | 04396-01275         | 4   | 3    | ANGLE           | 28480    | 04396-01275     |
| 2           | 04396-25004         | 7   | 1    | SPONGE          | 28480    | 04396-25004     |
| 3           | 0950-3208           | 1   | 1    | FDD 3.5 2MODE   | 28480    | 0950-3208       |
| 4           | 04396-61651         | 6   | 1    | FLAT CBL ASSY   | 28480    | 04396-61651     |
| 5           | 04396-61672         | 1   | 1    | WIRE ASSY       | 28480    | 04396-61672     |
| 6           | 0515-0914           | 8   | 31   | SCR-MACH M3X0.5 | 28480    | 0515-0914       |

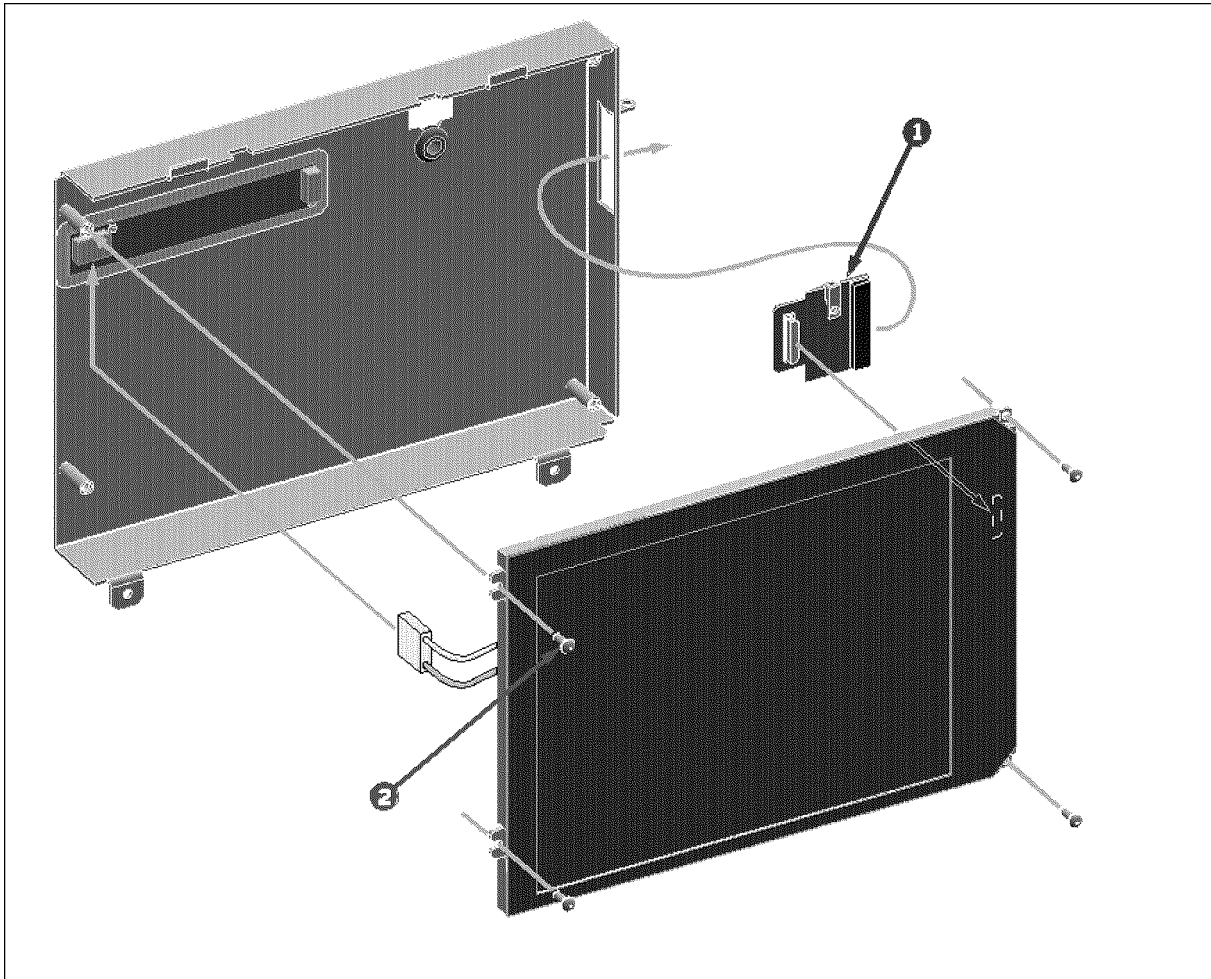
### Note



When the old FDD assembly (0955-3208) is faulty, replace both the FDD and the angle with new ones.

## Change 3

Change the Replaceable Parts as following.



CDS11047

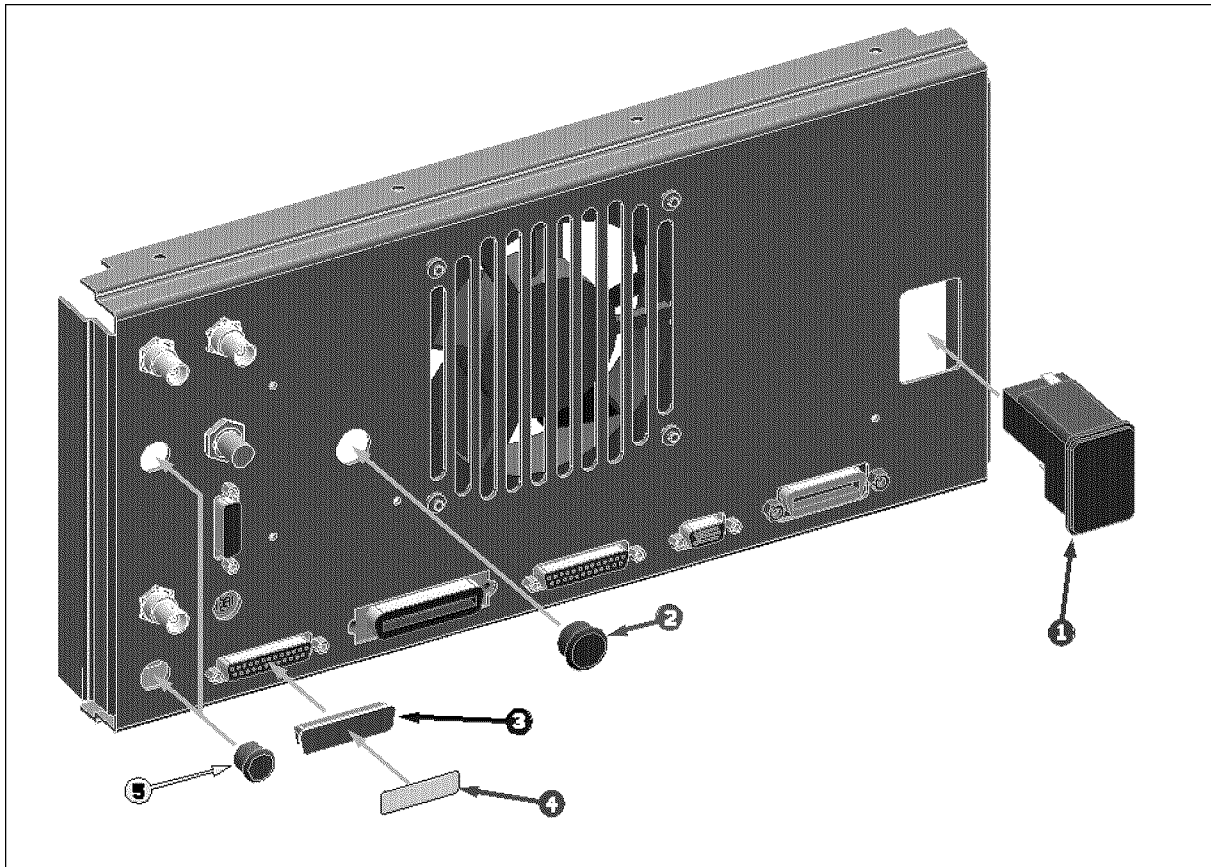
**Figure A-6. Front Assembly Parts 5/8**

**Table A-8. Front Assembly Parts 5/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description    | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|----------------|----------|-----------------|
| 1           | E4970-66539         | 2   | 1    | LCD MINI-BD    | 28480    | E4970-66539     |
| 2           | 0515-1550           | 0   | 4    | SCR M3-L 8 P-H | 28480    | 0515-1550       |

## Change 4

Change the Replaceable Parts as following.



CCS06036

**Figure A-7. Rear Assembly Parts 7/8**

**Table A-9. Rear Assembly Parts 7/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description  | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|--------------|----------|-----------------|
| 1           | 1252-6951           | 8   | 1    | AC INLET     | 28480    | 1252-6951       |
| 1           | 2110-0030           | 3   | 1    | FUSE 5A 250V | 28480    | 2110-0030       |
| 1           | 2110-1134           | 0   | 1    | FUSE DRAWER  | 28480    | 2110-1134       |
| 2           | 6960-0027           | 3   | 1    | PLUG-HOLE    | 28480    | 6960-0027       |
| 3           | 1252-4690           | 8   | 1    | DUST COVER   | 28480    | 1252-4690       |
| 4           | 04396-87111         | 7   | 1    | LABEL        | 28480    | 04396-87111     |
| 5           | 6960-0041           | 1   | 2    | PLUG HOLE    | 28480    | 6960-0041       |

## Fuse Selection

Select proper fuse according to the Table A-10.

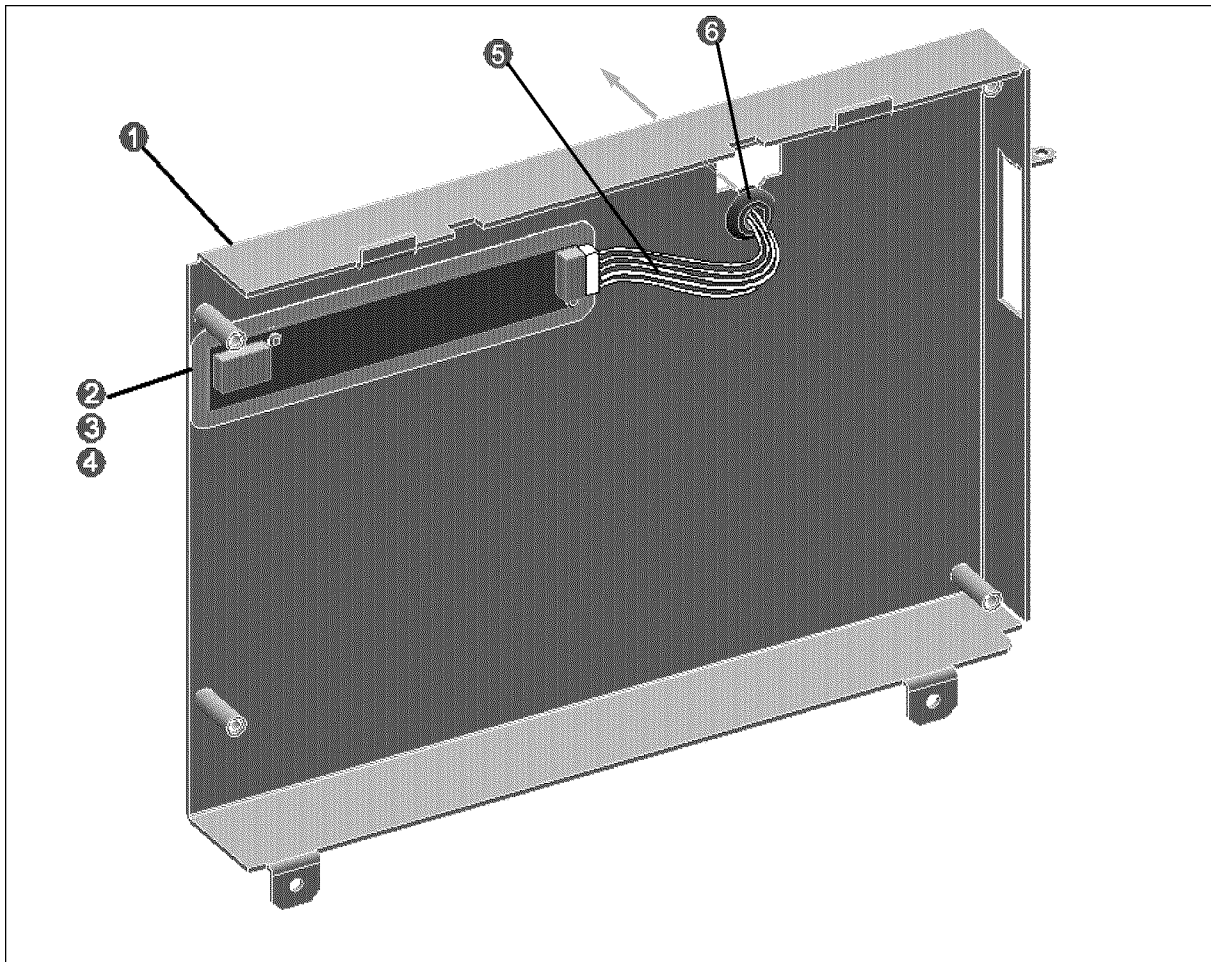
**Table A-10. Fuse Selection**

| Fuse Rating/Type                       | Fuse Part Number |
|----------------------------------------|------------------|
| 5A 250Vac<br>UL/CSA type<br>Time Delay | 2110-0030        |



## Change 5

Change the Replaceable Parts as following.

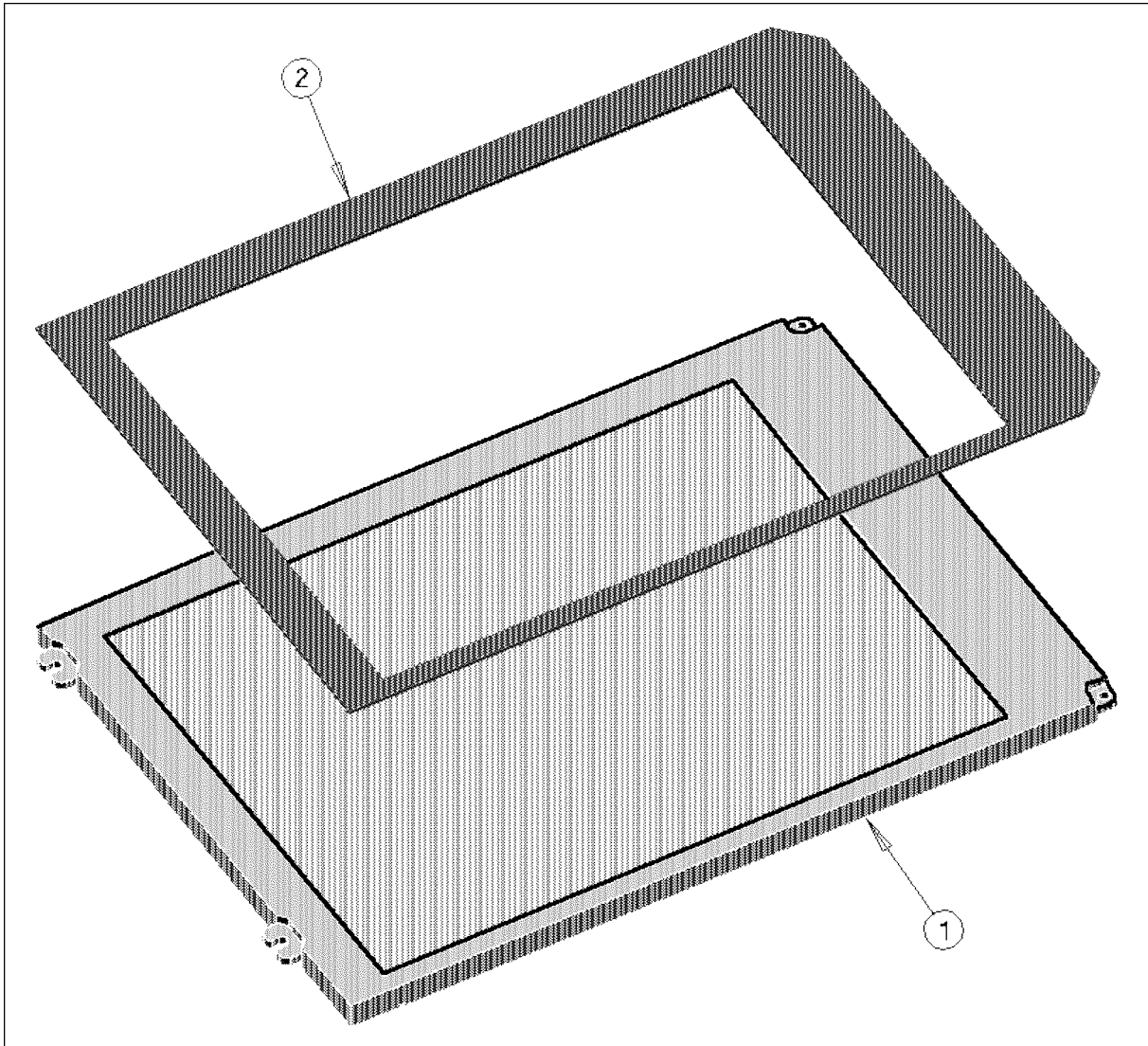


CDS11046

**Figure A-8. Front Assembly Parts 3/8**

**Table A-11. Front Assembly Parts 3/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description        | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|--------------------|----------|-----------------|
| 1           | E4970-04002         | 4   | 1    | Cover              | 28480    | E4970-04002     |
| 2           | E4970-25002         | 8   | 1    | Insulator          | 28480    | E4970-25002     |
| 3           | 0950-2924           | 6   | 1    | A54 Inverter Board | 28480    | 0950-2924       |
| 4           | 0515-0977           | 3   | 2    | SCR-MACH M2X0.4    | 28480    | 0515-0977       |
| 5           | 04396-61709         | 5   | 1    | Cable Assy         | 28480    | 04396-61709     |
| 6           | 0400-0010           | 2   | 1    | Gromet             | 28480    | 0400-0010       |



CDS11006

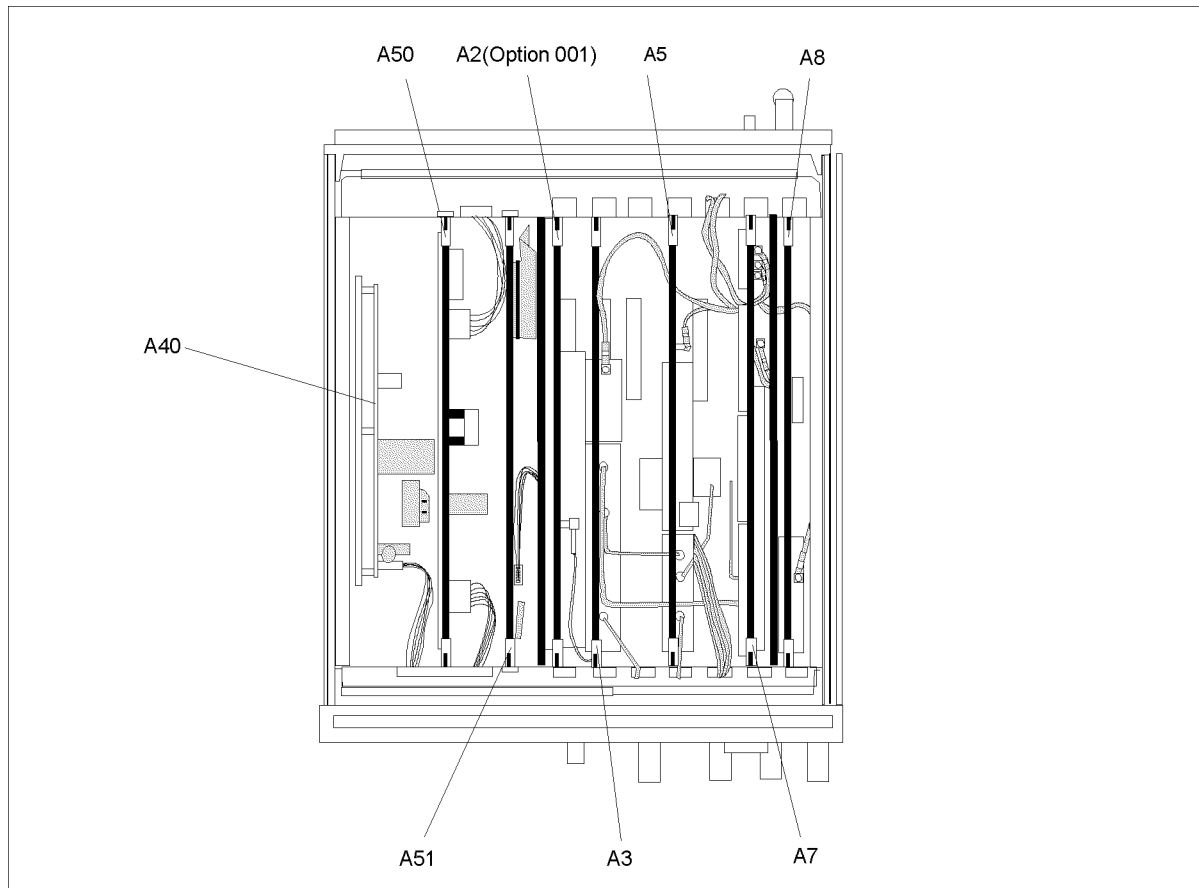
**Figure A-9. Front Assembly Parts 4/8**

**Table A-12. Front Assembly Parts 4/8**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|-------------|----------|-----------------|
| 1           | 2090-0574           | 6   | 1    | A52 LCD     | 28480    | 2090-0574       |
| 2           | 04396-25071         | 8   | 1    | Gasket      | 28480    | 04396-25071     |

## Change 6

Change the Replaceable Parts as following.

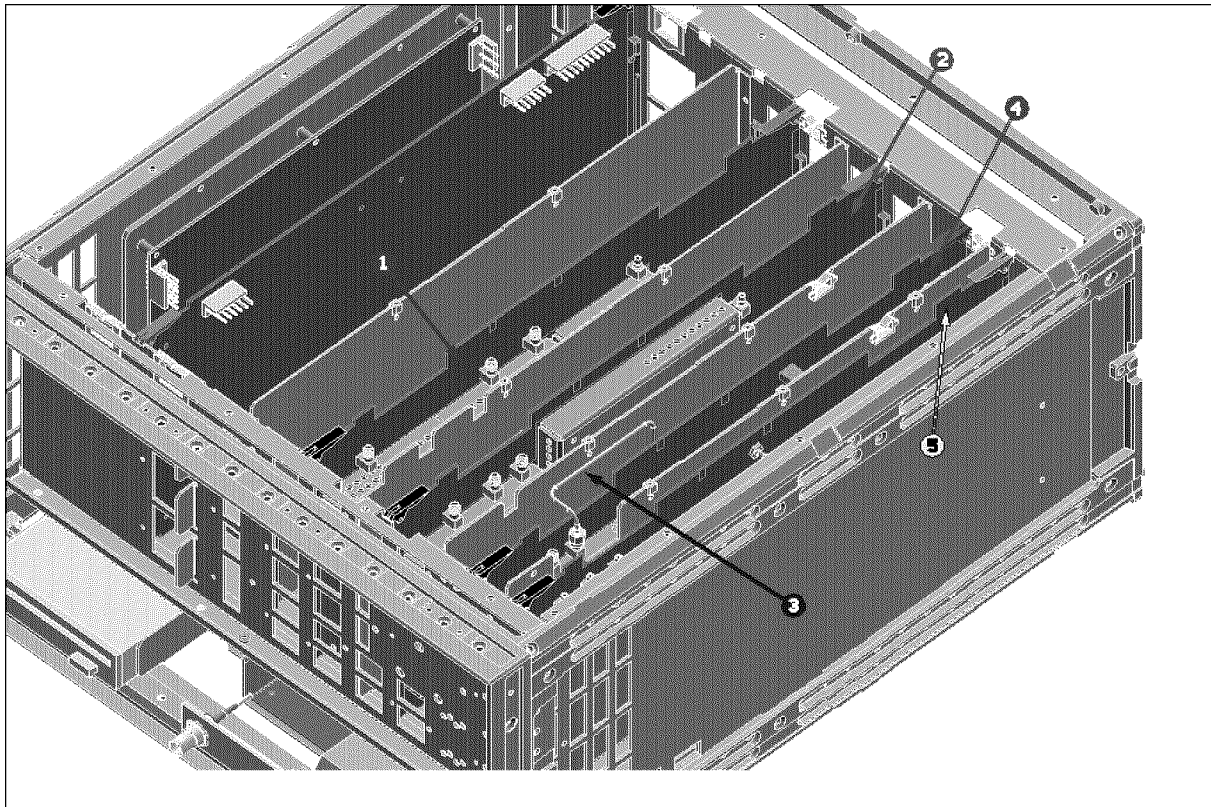


CCS06016

**Figure A-10. Top View (Major Assemblies)**

**Table A-13. Top View (Major Assemblies)**

| Ref.<br>Desig. | Agilent Part<br>Number | C<br>D | Qty. | Description                             | Mfr<br>Code | Mfr Part<br>Number |
|----------------|------------------------|--------|------|-----------------------------------------|-------------|--------------------|
| A2             | E4970-66502            | 9      | 1    | DC BIAS (Opt. 001)                      | 28480       | E4970-66502        |
| A3             | E4970-66503            | 0      | 1    | TRACKING SOURCE                         | 28480       | E4970-66503        |
|                | E4970-69503            |        | 1    | TRACKING SOURCE<br>(rebuilt-exchange)   | 28480       | E4970-69503        |
| A5             | E4970-66505            | 2      | 1    | LOCAL SYNTHESIZER                       | 28480       | E4970-66505        |
|                | E4970-69505            |        |      | LOCAL SYNTHESIZER<br>(rebuilt-exchange) | 28480       | E4970-69505        |
| A7             | E4970-66507            | 4      | 1    | FREQ. CONVERTER                         | 28480       | E4970-66507        |
|                | E4970-69507            |        |      | FREQ. CONVERTER<br>(rebuilt-exchange)   | 28480       | E4970-69507        |
| A8             | E4970-66508            | 5      | 1    | DIGITAL IF                              | 28480       | E4970-66508        |
|                | E4970-69508            |        |      | DIGITAL IF<br>(rebuilt-exchange)        | 28480       | E4970-69508        |
| A40            | 0950-3246              | 7      | 1    | PRE-REGULATOR                           | 28480       | 0950-3246          |
| A50            | E4970-66550            | 7      | 1    | DC-DC CONVERTER                         | 28480       | E4970-66550        |
| A51            | E4970-66551            | 8      | 1    | GSP                                     | 28480       | E4970-66551        |

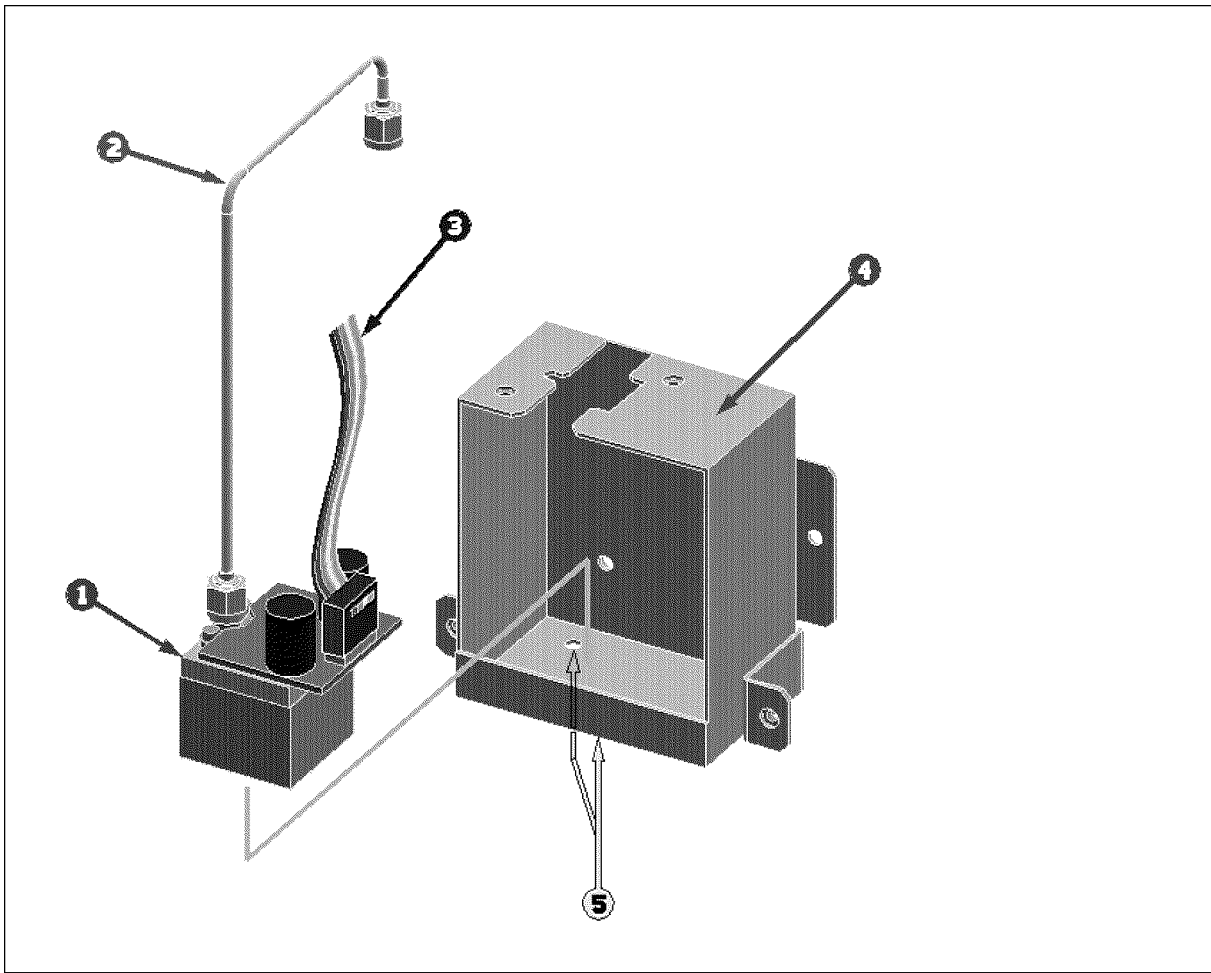


CCS06055

**Figure A-11. Main Frame Assembly Parts (A5 and A7 Assemblies) 18/23**

**Table A-14. Main Frame Assembly Parts (A5 and A7 Assemblies) 18/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description                                | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|--------------------------------------------|----------|-----------------|
| 1           | E4970-66503         | 0   | 1    | TRACKING SOURCE                            | 28480    | E4970-66503     |
| 2           | E4970-66505         | 2   | 1    | A5 LOCAL SYNTHESIZER                       | 28480    | E4970-66515     |
|             | E4970-69515         |     |      | A5 LOCAL SYNTHESIZER<br>(rebuilt-exchange) | 28480    | E4970-69515     |
| 3           | E4970-61615         | 5   | 1    | RF CBL ASSY                                | 28480    | E4970-61615     |
| 4           | E4970-66507         | 4   | 1    | A7 FREQ. CONVERTER                         | 28480    | E4970-66507     |
|             | E4970-69507         |     |      | A7 FREQ. CONVERTER<br>(rebuilt-exchange)   | 28480    | E4970-69507     |
| 5           | E4970-66508         | 5   | 1    | DIGITAL IF                                 | 28480    | E4970-66508     |



CCS06057

**Figure A-12. Main Frame Assembly Parts (YTO Assembly) 20/23**

**Table A-15. Main Frame Assembly Parts (YTO Assembly) 20/23**

| Ref. Desig. | Agilent Part Number | C D | Qty. | Description   | Mfr Code | Mfr Part Number |
|-------------|---------------------|-----|------|---------------|----------|-----------------|
| 1           | 0955-0777           | 3   | 1    | YTO 3-6GHZ    | 28480    | 0955-0777       |
| 2           | E4970-61613         | 3   | 1    | RF CBL ASSY   | 28480    | E4970-61613     |
| 3           | 08590-60035         | 2   | 1    | CABLE ASSY    | 28480    | 08590-60035     |
| 4           | E4970-00626         | 0   | 1    | CASE SHIELD   | 28480    | E4970-00626     |
| 5           | 2200-0101           | 0   | 2    | SCR-MACH 4-40 | 28480    | 2200-0101       |

**Note**



When the old YTO assembly (0955-0777) is faulty, replace both the YTO, the A5 board and the cable assembly with new ones.

---

## Serial Number

Agilent Technologies uses a two-part, nine-character serial number that is stamped on the serial number plate (see Figure A-13) attached to the rear panel. The first four digits and the letter are the serial prefix and the last five digits are the suffix.



**Figure A-13. Serial Number Plate**





## Power Requirement

---

### Replacing Fuse

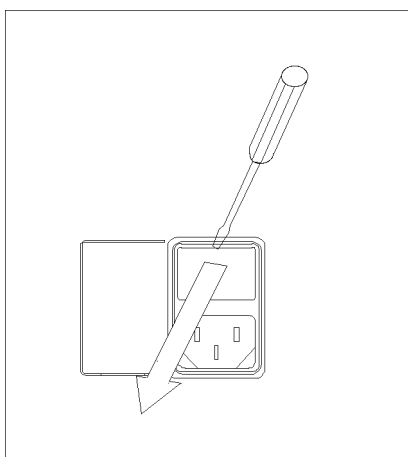
#### Fuse Selection

Select proper fuse according to the Table A-10.

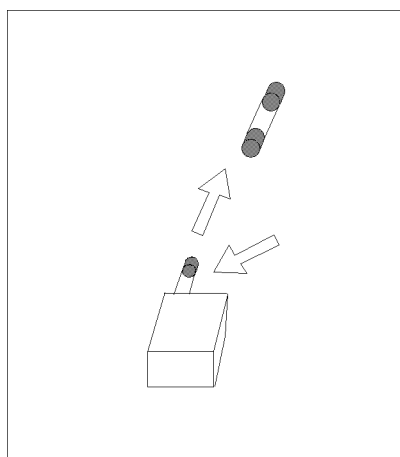
**Table B-1. Fuse Selection**

| Fuse Rating/Type                       | Fuse Part Number |
|----------------------------------------|------------------|
| 5A 250Vac<br>UL/CSA type<br>Time Delay | 2110-1303        |

For ordering the fuse, contact your nearest Agilent Technologies Sales and Service Office.



Open the cover of AC line receptacle on the rear panel using a small minus screwdriver.



To check or replace the fuse, pull the fuse holder and remove the fuse. To reinstall the fuse, insert a fuse with the proper rating into the fuse holder.

---

## Power Requirements

The 4395A requires the following power source:

Voltage : 90 to 132 Vac, 198 to 264 Vac

Frequency : 47 to 63 Hz

Power : 300 VA maximum

### Power Cable

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate ac power outlet, this cable grounds the instrument frame.

The type of power cable shipped with each instrument depends on the country of destination. Refer to Figure B-1 for the part numbers of the power cables available.

---

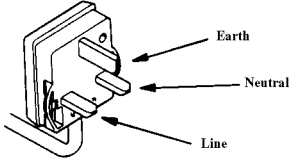
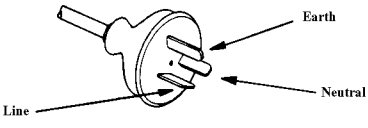
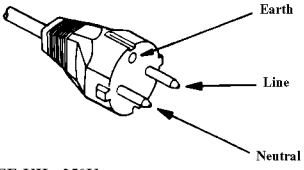
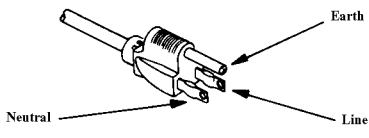
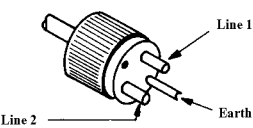
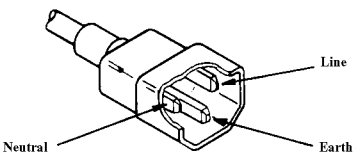
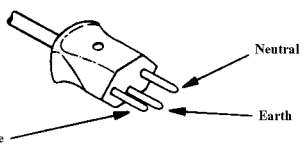
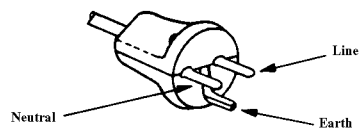
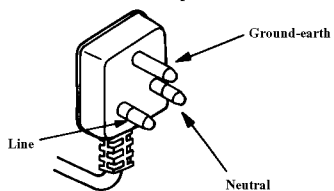
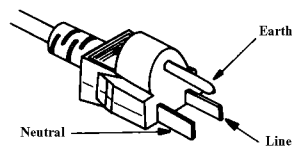
#### Warning



**For protection from electrical shock, the power cable ground must not be defeated.**

**The power plug must be plugged into an outlet that provides a protective earth ground connection.**

---

|                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>OPTION 900</b>                      <b>United Kingdom</b></p>  <p>Plug : BS 1363A, 250V<br/>Cable : 8120-1351</p>                                               | <p><b>OPTION 901</b>                      <b>Australia / New Zealand</b></p>  <p>Plug : NZSS 198/AS C112, 250V<br/>Cable : 8120-1369</p> |
| <p><b>OPTION 902</b>                      <b>European Continent</b></p>  <p>Plug : CEE-VII, 250V<br/>Cable : 8120-1689</p>                                            | <p><b>OPTION 903</b>                      <b>U.S. / Canada</b></p>  <p>Plug : NEMA 5-15P, 125V, 15A<br/>Cable : 8120-1378</p>            |
| <p><b>OPTION 904</b>                      <b>U.S. / Canada</b></p>  <p>Plug : NEMA 6-15P, 250V, 15A<br/>Cable : 8120-0698</p>                                         | <p><b>OPTION 905*</b>                      <b>Any country</b></p>  <p>Plug : CEE 22-VI, 250V<br/>Cable : 8123-1396</p>                   |
| <p><b>OPTION 906</b>                      <b>Switzerland</b></p>  <p>Plug : SEV 1011.1959-24507 Type 12, 250V<br/>Cable : 8120-2104</p>                             | <p><b>OPTION 912</b>                      <b>Denmark</b></p>  <p>Plug : DHCR 107, 220V<br/>Cable : 8120-2956</p>                       |
| <p><b>OPTION 917</b>                      <b>India / Republic of S.Africa</b></p>  <p>Plug : SABS 164, 250V<br/>Cable : 8120-4211</p>                               | <p><b>OPTION 918</b>                      <b>Japan</b></p>  <p>Plug : JIS C 8303, 125V, 15A<br/>Cable : 8120-4753</p>                  |
| <p>NOTE: Each option number includes a 'family' of cords and connectors of various materials and plug body configurations (straight, 90° etc.).</p> <p>* Plug option 905 is frequently used for interconnecting system components and peripherals.</p> |                                                                                                                                                                                                                            |

**Figure B-1. Power Cable Supplied**



## Error Messages

---

This section lists the error messages that are displayed on the analyzer display or transmitted by the instrument over GPIB. Each error message is accompanied by an explanation, and suggestions are provided to help in solving the problem. Where applicable, references are provided to the related chapter of the appropriate manual.

When displayed, error messages are preceded with the word “CAUTION:.” That part of the error message has been omitted here for the sake of brevity. Some messages without the “CAUTION:” are for information only, and do not indicate an error condition. The messages are listed first in alphabetical order because the displayed messages do not contain the message number. The messages are then listed in numerical order to make them easier to find if they are read over the GPIB.

In addition to error messages, The analyzer’s status is indicated by status notations in the left margin of the display. Examples are \*, **Cor**, and **Avg**. Sometimes these appear together with error messages.

---

### Error Messages in Alphabetical Order

#### A

##### 10    **ADDITIONAL STANDARDS NEEDED**

Error correction for the selected calibration class cannot be computed until all the necessary standards have been measured.

##### 84    **ANALYZER TYPE MISMATCH**

The analyzer receives a command that is not available for the current analyzer type. Please confirm GPIB command or change analyzer type before sending the command.

#### B

##### 17    **BACKUP DATA LOST**

Data checksum error on the battery backup memory has occurred. The battery is recharged for approximately 10 minutes after power was turned ON.

## **Error Messages in Alphabetical Order**

### **–160 Block data error**

This error, as well as errors –161 and –168, are generated when analyzing the syntax of a block data element. This particular error message is used if the analyzer cannot detect a more specific error.

### **–168 Block data not allowed**

A legal block data element was encountered but was not allowed by the analyzer at this point in parsing.

## **C**

### **13 CALIBRATION ABORTED**

The calibration in progress was terminated due to a change of the active channel or stimulus parameters.

### **11 CALIBRATION REQUIRED**

No valid calibration coefficients were found when you attempted to turn calibration ON.

### **126 CAN'T CHANGE NUMBER OF POINTS**

The number of points of the spectrum analyzer mode cannot be to change manually, except in zero span.

### **133 CAN'T CHANGE ON LIST SWEEP**

When list sweep is selected, the following parameters are not allowed to be changed:

- CENTER, SPAN, START, STOP
- NOP
- IFBW or RBW
- POWER
- DC SOURCE

Modify the list table to change these parameters in the list sweep.

### **97 CAN'T CHANGE WHILE DATA MATH ON**

The setting cannot be changed when the data math function is used.

### **99 CAN'T CHANGE WHILE DUAL CHAN OFF**

The Cross channel cannot be turned on when dual channel is off. Turn on the dual channel before the cross channel is turned on.

### **82 CAN'T CHANGE- ANOTHER CONTROLLER ON BUS**

The analyzer cannot assume the mode of system controller until the active controller is removed from the bus or relinquishes the bus. See *Programming Manual*.

**134 CAN'T COUPLE IN CURRENT INPUTS**

When one channel measures a ratio measurement, and the other one measures an absolute measurement (for example: A/R and B), **COUPLED CH** can not be turned on.

**114 CAN'T SAVE GRAPHICS WHEN COPY IN PROGRESS**

If you attempt to save graphics when a print is in progress, this error message is displayed.

**1 CAN'T SET RBW AUTO IN ZERO SPAN**

The RBW AUTO mode cannot be selected in the zero span. The RBW must be specified manually in the zero span. (spectrum analyzer mode only).

**127 CAN'T SET SWEEP TIME AUTO IN ZERO SPAN**

The automatic sweep time cannot be in zero span of the spectrum analyzer mode. (The network analyzer mode allows that the automatic sweep time is turned on.)

**–281 Cannot create program**

Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory.

**–140 Character data error**

This error, as well as errors –141 through –148, are generated when analyzing the syntax of a character data element. This particular error message is used if the analyzer cannot detect a more specific error.

**–148 Character data not allowed**

A legal character data element was encountered where prohibited by the analyzer.

**–144 Character data too long**

The character data element contains more than twelve characters (see IEEE 488.2, 7.7.1.4).

**–100 Command error**

This is a generic syntax error that the analyzer cannot detect more specific errors. This code indicates only that a command error, as defined in IEEE 488.2, 11.5.1.1.4, has occurred.

**–110 Command header error**

An error was detected in the header. This error message is used when the analyzer cannot detect the more specific errors described for errors –111 through –119.

**75 COMMAND IGNORED - SEGMENT NOT DONE YET**

The GPIB command the analyzer received is ignored, because the segment is editing (*GPIB only*). Send LIMSDON (limit segment done) or SDON (segment done) to terminate editing segment. (See *Programming Manual*.)

## **Error Messages in Alphabetical Order**

### **269 COMPENSATION ABORTED**

Compensation data acquisition process is aborted.

### **267 COMPENSTATION REQUIRED**

Compensation is required. Perform compansation to obtain compensation data.

### **50 CONT SWITCHING MAY DAMAGE MECH SW**

RF output power switch, input attenuator switch at input R/A/B, or internal mechanical switch in the S-parameter test set is switching sweep by sweep, because RF power level or the input attenuator setting is different between two channels and the dual channel is turn on, or continuous trigger mode is selected after full 2-port calibration is performed when 4395A is used with the S-parameter test set. To avoid premature wearing out of the output power switch, input attenuator switch, or internal switch of the S-parameter test set, change trigger type to HOLD, SINGLE, or NUMBER of GROUP to hold sweep after measurement required. Or, for example, turn off the dual channel, or set the power level and the input attenuator of both channels to the same setting.

### **135 COUPLED CHAN - BETWEEN NA&NA OR ZA&ZA**

The analyzer types of both channels must be the network analyzer mode or impedance analyzer mode when the coupled channel is turned on. It is not possible to turn the coupled channel on in spectrum analyzer mode.

### **74 CURRENT EDITING SEGMENT SCRATCHED**

The current editing segment for the list table and the limit line is scratched when the following cases occur (*GPIB only*) :

- When EDITLIST (edit list table) command is received while editing a segment for the list table.
- When EDITLIML (edit limit line) command is received while editing a segment for the limit line.

Send LIMSDON (limit segment done) or SDON (segment done) to terminate editing segment.

### **16 CURRENT PARAMETER NOT IN CAL SET**

*GPIB only.* Correction is not valid for the selected measurement parameter.

## **D**

### **–230 Data corrupt or stale**

Possibly invalid data. New reading started but not completed since last access.

### **–225 Data out of memory**

The analyzer has insufficient memory to perform the requested operation.



**–222 Data out of range**

A legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the analyzer (see IEEE 488.2, 11.5.1.1.5).

**–231 Data questionable**

Indicates that measurement accuracy is suspect.

**–104 Data type error**

The parser recognized an unallowed data element. For example, numeric or string data was expected but block data was encountered.

**137 DC CURRENT LIMIT OCCURED**

The output current at DC SOURCE port is reached to an upper limit and the output voltage is reduced so that the current does not exceed the upper limit. This message appears when the DC SOURCE port is used in voltage control mode.

**136 DC SOURCE OVERLOAD**

The DC SOURCE output is overloaded.

**138 DC VOLTAGE LIMIT OCCURED**

The output voltage at DC SOURCE port is reached to an upper limit and the output current is reduced so that the voltage does not exceed the upper limit. This message appears when the DC SOURCE port is used in current control mode.

**37 DISPLAY BUFFER IS FULL**

The display buffer is filled with the overlay traces or traces drawn by IBASIC DRAW/MOVE commands, etc.

**117 DUPLICATE FILE EXTENSION**

The extension name entered is already used for other file types. Use other extension name.

**E**

**15 EXCEEDED 7 STANDARDS PER CLASS**

A maximum of seven standards can be defined for any class.

**–200 Execution error**

This is the generic syntax error that the analyzer cannot detect more specific errors. This code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.

## Error Messages in Alphabetical Order

### –123    **Exponent too large**

The magnitude of the exponent was larger than 32000 (see IEEE 488.2, 7.7.2.4.1).

## F

### –257    **File name error**

Indicates that a legal program command or query could not be executed because the file name on the device media was in error. For example, an attempt was made to copy to a duplicate file name. The definition of what constitutes a file name error is device-specific.

### –256    **File name not found**

A legal program command could not be executed because the file name on the device media was not found: for example, an attempt was made to read or copy a nonexistent file.

### 143    **FLOATING POINT ERROR OCCURED**

Indicate that a floating point error occurred in the analyzer. Data processing may not be correct. This error message is used when an internal application was executed for illegal data sent from an external device, or when an internal software bug was detected. Contact your nearest Agilent Technologies office.

### 83    **FORMAT NOT VALID FOR MEASUREMENT**

The conversion function except the 1/S and the multiple phase modes is not valid for the Smith, admittance, and SWR formats.

### 131    **FREQUENCY SWEEP ONLY**

The sweep type must be frequency sweep when the center step size is set.

## G

### –105    **GET not allowed**

A Group Execute Trigger (GET) was received within a program message (see IEEE 488.2, 7.7).

## H

### –240    **Hardware error**

Indicates that a legal program command or query could not be executed because of a hardware problem in the analyzer. Definition of what constitutes a hardware problem is completely device-specific. This error message is used when the analyzer cannot detect the more specific errors described for errors –241 through –249.

**–241 Hardware missing**

A legal program command or query could not be executed because of missing analyzer hardware. For example, an option was not installed.

**–111 Header separator error**

A character that is not a legal header separator was encountered while parsing the header. For example, no white space followed the header, thus \*SRE4 is an error.

**–114 Header Suffix out of range**

The value of a numeric suffix attached to a program mnemonic makes the header invalid.

**I**

**–224 Illegal parameter value**

Used where exact value, from a list of possibilities, was expected.

**–282 Illegal program name**

The name used to reference a program was invalid. For example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.

**–283 Illegal variable name**

An attempt was made to reference a nonexistent variable in a program.

**–213 Init ignored**

A request for a measurement initiation was ignored as another measurement was already in progress.

**141 INSUFFICIENT MEMORY**

If a lot of tasks is executed at same time, memory might be insufficient for a while. (For example, running HP Instrument BASIC program, printing a screen, and sending or receiving data array by GPIB are required at same time.) Please wait until finishing some tasks then execute the next task.

**–161 Invalid block data**

A block data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.6.2). For example, an END message was received before the length was satisfied.

**–141 Invalid character data**

Either the character data element contains an invalid character or the particular element received is not valid for the header.

## Error Messages in Alphabetical Order

### –121 Invalid character in number

An invalid character for the data type being parsed was encountered. For example, an alpha character in a decimal numeric or a “9” in octal data.

### –101 Invalid character

A syntax element contains a character that is invalid for that type. For example, a header containing an ampersand (SENSE&).

### 154 INVALID DATE

The date entered to set the real time clock is invalid. Reenter correct date.

### 112 INVALID FILE NAME

*GPIB only.* The file name for the RECALL, PURGE, or RE-SAVE function must have a “\_D” or “\_S” extension for LIF format.

### –103 Invalid separator

The parser was expecting a separator and encountered an illegal character. For example, the semicolon was omitted after a program message unit, \*RST:TRIG.

### –151 Invalid string data

A string data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.5.2). For example, an END message was received before the terminal quote character.

### –131 Invalid suffix

The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for the analyzer.

## L

### 115 LIF-DOS COPY NOT ALLOWED

If you try to copy a file between the memory disk and the flexible disk when the format of the memory disk is different from the format of the flexible disk, this message is displayed.

### 124 LIST TABLE EMPTY OR INSUFFICIENT TABLE

The frequency list is empty. To implement the list frequency mode, add segments to the list table.

## M

### –250 Mass storage error

Indicates that a mass storage error occurred. This error message is used when the analyzer cannot detect the more specific errors described for errors –257.

**-311 Memory error**

An error was detected in the analyzer's memory.

**-109 Missing parameter**

Fewer parameters were received than required for the header. For example, the \*SRE command requires one parameter, so receiving only \*SRE is not allowed.

**N**

**98 NO ACTIVE MARKER**

The marker→ command cannot be execute when no marker is displayed on the screen. Turn on the marker before executing the marker→ commands.

**12 NO CALIBRATION CURRENTLY IN PROGRESS**

The **RESUME CAL SEQUENCE** softkey is not valid unless a calibration is in progress. Start a new calibration.

**268 NO COMPENSATION CURRENTLY IN PROGRESS**

No compensation is currently in progress.

**119 NO DATA TRACE DISPLAYED**

The **SCALE FOR [DATA]** is selected when the data trace is not displayed.

**93 NO DATA TRACE**

The **MARKER ON [DATA]** is selected when the data trace is not displayed.

**+0 No error**

The error queue is empty. Every error in the queue has been read (OUTPERRO? query) or the queue was cleared by power-on or the \*CLS command.

**100 NO FIXED DELTA MARKER**

The **FIXED ΔMKR VALUE** and **FIXED ΔMKR AUX VALUE** softkey requires that fixed delta marker is turned ON.

**96 NO MARKER DELTA - RANGE NOT SET**

The **MKRΔ→SEARCH RNG** softkey requires that delta marker is turned ON.

**95 NO MARKER DELTA - SPAN NOT SET**

The **MKRΔ→SPAN** softkey requires that delta marker mode be turned ON.

## Error Messages in Alphabetical Order

### 120 NO MEMORY TRACE DISPLAYED

The `SCALE FOR [MEMORY]` is selected when the memory trace is not displayed.

### 94 NO MEMORY TRACE

The `MARKER ON [MEMORY]` is selected when the memory trace is not displayed.

### 113 NO STATE/DATA FILES ON DISK

There are no files on the flexible disk with extensions, “\_D” or “\_S” for LIF format, or “STA” or “.DTA” for DOS format.

### 116 NO STATE/DATA FILES ON MEMORY

There are no files on the memory disk with extensions, “\_D” or “\_S” for LIF format, or “.STA” or “.DTA” for DOS format.

### 184 NOT ALLOWED IN SVC MODE

The operation is not allowed in service mode.

### 55 NOT ENOUGH DATA

The amount of data sent to the analyzer is less than that expected (*GPIB only*).

### 14 NOT VALID FOR PRESENT TEST SET

The calibration requested is inconsistent with the test set present. This message occurs in the following situations:

- A full 2-port calibration is requested with a test set other than an S-parameter test set.
- A one-path 2-port calibration is requested with an S-parameter test set (this procedure is typically used with a transmission/reflection test set).

### 34 NO VALID MEMORY TRACE

If a memory trace is to be displayed or otherwise used, a data trace must first be stored to memory.

### –120 Numeric data error

This error, as well as errors –121 through –129, are generated when parsing a data element that appears to be numeric, including the nondecimal numeric types. This particular error message is used if the analyzer cannot detect a more specific error.

### –128 Numeric data not allowed

A legal numeric data element was received, but the analyzer does not accept it in this position for a header.

## O

**146 ON POINT NOT ALLOWD FOR THE CURRENT TRIG**

The trigger event mode cannot be changed to the ON POINT mode because the current trigger source setting does not allow the ON POINT mode. The ON POINT mode is available for only MANUAL, EXTERNAL, and BUS trigger sources of the network analyzer mode.

**56 OPTION NOT INSTALLED**

This error occurs when an GPIB command which is optional command is sent and the analyzer is not installed the option (*GPIB only*). Please confirm options installed to the analyzer using \*OPT? command (see *Programming Manual*.)

**45 OVERLOAD ON INPUT A**

The power level at one of the four receiver inputs exceeds a certain level greater than the maximum input level.

**44 OVERLOAD ON INPUT B**

The power level at one of the four receiver inputs exceeds a certain level greater than the maximum input level.

**46 OVERLOAD ON INPUT R**

The power level at one of the four receiver inputs exceeds a certain level greater than the maximum input level.

**P**

**–220 Parameter error**

Indicates that a program data element related error occurred. This error message is used when the analyzer cannot detect the more specific errors described for errors –221 through –229.

**–108 Parameter not allowed**

More parameters were received than expected for the header. For example, the \*SRE command only accepts one parameter, so receiving \*SRE 4,16 is not allowed.

**48 PHASE LOCK LOOP UNLOCKED**

EXT REF Input of 10 MHz is not proper, or the instrument is needed to adjust or repair. Check the external reference signal first. Contact your nearest Agilent Technologies office for adjustment or repair.

**193 POWER ON TEST FAILED**

Power on test failed. Contact your nearest Agilent Technologies office.

## Error Messages in Alphabetical Order

### 26 **PRINTER: not on, not connected, out of paper**

The printer does not respond to control. Check the supply to the printer, online status, sheets, and so on.

### –284 **Program currently running**

Certain operations dealing with programs may be illegal while the program is running. For example, deleting a running program might not be possible.

### –280 **Program error**

Indicates that a downloaded program-related execution error occurred. This error message is used when the analyzer cannot detect the more specific errors described for errors –281 through –289.

### –112 **Program mnemonic too long**

The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).

### –286 **Program runtime error**

A program runtime error of the HP Instrument BASIC has occurred. To get a more specific error information, use the **ERRM\$** or **ERRN** command of the HP Instrument BASIC.

### –285 **Program syntax error**

Indicates that a syntax error appears in a downloaded program. The syntax used when parsing the downloaded program is device-specific.

## Q

### –400 **Query errors**

This is the generic query error that the analyzer cannot detect more specific errors. This code indicates only that a query error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.

### –410 **Query INTERRUPTED**

A condition causing an interrupted query error occurred (see IEEE 488.2, 6.3.2.3). For example, a query followed by **DAB** or **GET** before a response was completely sent.

### –420 **Query UNTERMINATED**

A condition causing an unterminated query error occurred (see IEEE 488.2, 6.3.2.2). For example, the analyzer was addressed to talk and an incomplete program message was received by the controller.

### –350 **Queue overflow**

A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.



**R**

**111 RECALL ERROR: INSTR STATE PRESET**

A serious error, for example corrupted data, is detected on recalling a file, and this forced the analyzer to be PRESET.

**S**

**110 SAVE ERROR**

A serious error, for example physically damaged disk surface, is detected on saving a file.

**76 SEGMENT START/STOP OVERLAPPED**

Segments are not allowed to be overlapped. Reenter appropriate value for start or stop value of segments to avoid that segment is not overlapped.

**–330 Self-test failed**

A self-test failed. Contact your nearest Agilent Technologies office or see the *Service Manual* for troubleshooting.

**–221 Settings conflict**

A legal program data element was parsed but could not be executed due to the current device state (see IEEE 488.2, 6.4.5.3 and 11.5.1.1.5).

**128 SPAN = 0 ONLY**

The setup must be zero span and spectrum analyzer mode when turning on the RF OUTPUT.

**–150 String data error**

This error, as well as errors –151 and –158, are generated when analyzing the syntax of a string data element. This particular error message is used if the analyzer cannot detect a more specific error.

**–158 String data not allowed**

A string data element was encountered but was not allowed by the analyzer at this point in parsing.

**–130 Suffix error**

This error, as well as errors –131 through –139, are generated when parsing a suffix. This particular error message is used if the analyzer cannot detect a more specific error.

## **Error Messages in Alphabetical Order**

### **–138 Suffix not allowed**

A suffix was encountered after a numeric element that does not allow suffixes.

### **–134 Suffix too long**

The suffix contained more than 12 characters (see IEEE 488.2, 7.7.3.4).

### **–102 Syntax error**

An unrecognized command or data type was encountered. For example, a string was received when the analyzer was not expecting to receive a string.

### **–310 System error**

Some error, termed “system error” by the analyzer, has occurred.

## **T**

### **–124 Too many digits**

The mantissa of a decimal numeric data element contains more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

### **77 TOO MANY SEGMENTS OR POINTS**

Frequency list mode is limited to 31 segments or 801 points.

### **64 TOO MANY SEGMENTS**

The maximum number of segments for the limit line table is 18.

### **–223 Too much data**

A legal program data element of block, expression, or string type was received that contained more data than the analyzer could handle due to memory or related device-specific requirements.

### **54 TOO MUCH DATA**

Either there is too much binary data to send to the analyzer when the data transfer format is FORM 2, FORM 3 or FORM 5, or the amount of data is greater than the number of points.

### **78 TOO SMALL POINTS OR TOO LARGE STOP**

STOP+SPAN/(NOP–1) is out of sweep range. Increase NOP or change STOP value to lower frequency to avoid this error.

### **–210 Trigger error**

A trigger related error occurred. This error message is used when the analyzer cannot detect the more specific errors described for errors –211 through –219.

**–211 Trigger ignored**

A GET, \*TRG, or triggering signal was received and recognized by the analyzer but was ignored because of analyzer timing considerations. For example, the analyzer was not ready to respond.

**U**

**–113 Undefined header**

The header is syntactically correct, but it is undefined for the analyzer. For example, \*XYZ is not defined for the analyzer.

**19 UNEXPECTED DATA DETECTED: CAL ABORTED**

The signal measured for the level cal is not adequate for the calibration signal. (spectrum analyzer mode only.)

## Error Messages in Numerical Order

### 0 - 100

#### +0 No error

The error queue is empty. Every error in the queue has been read (OUTPERRO? query) or the queue was cleared by power-on or the \*CLS command.

#### 1 CAN'T SET RBW AUTO IN ZERO SPAN

The RBW AUTO mode cannot be selected in the zero span. The RBW must be specified manually in the zero span. (spectrum analyzer mode only).

#### 10 ADDITIONAL STANDARDS NEEDED

Error correction for the selected calibration class cannot be computed until all the necessary standards have been measured.

#### 11 CALIBRATION REQUIRED

No valid calibration coefficients were found when you attempted to turn calibration ON.

#### 12 NO CALIBRATION CURRENTLY IN PROGRESS

The **RESUME CAL SEQUENCE** softkey is not valid unless a calibration is in progress. Start a new calibration.

#### 13 CALIBRATION ABORTED

The calibration in progress was terminated due to a change of the active channel or stimulus parameters.

#### 14 NOT VALID FOR PRESENT TEST SET

The calibration requested is inconsistent with the test set present. This message occurs in the following situations:

- A full 2-port calibration is requested with a test set other than an S-parameter test set.
- A one-path 2-port calibration is requested with an S-parameter test set (this procedure is typically used with a transmission/reflection test set).

#### 15 EXCEEDED 7 STANDARDS PER CLASS

A maximum of seven standards can be defined for any class.

#### 16 CURRENT PARAMETER NOT IN CAL SET

*GPIB only.* Correction is not valid for the selected measurement parameter.

**17    BACKUP DATA LOST**

Data checksum error on the battery backup memory has occurred. The battery is recharged for approximately 10 minutes after power was turned ON.

**19    UNEXPECTED DATA DETECTED: CAL ABORTED**

The signal measured for the level cal is not adequate for the calibration signal. (spectrum analyzer mode only.)

**26    PRINTER: not on, not connect, wrong address**

The printer does not respond to control. Check the supply to the printer, online status, sheets, and so on.

**34    NO VALID MEMORY TRACE**

If a memory trace is to be displayed or otherwise used, a data trace must first be stored to memory.

**37    DISPLAY BUFFER IS FULL**

The display buffer is filled with the overlay traces or traces drawn by IBASIC DRAW/MOVE commands, etc.

**44    OVERLOAD ON INPUT B**

The power level at one of the four receiver inputs exceeds a certain level greater than the maximum input level.

**45    OVERLOAD ON INPUT A**

The power level at one of the four receiver inputs exceeds a certain level greater than the maximum input level.

**46    OVERLOAD ON INPUT R**

The power level at one of the four receiver inputs exceeds a certain level greater than the maximum input level.

**48    PHASE LOCK LOOP UNLOCKED**

EXT REF Input of 10 MHz is not proper, or the instrument is needed to adjust or repair. Check the external reference signal first. Contact your nearest Agilent Technologies office for adjustment or repair.

## Error Messages in Numerical Order

### 50 CONT SWITCHING MAY DAMAGE MECH SW

RF output power switch, input attenuator switch at input R/A/B, or internal mechanical switch in the S-parameter test set is switching sweep by sweep, because RF power level or the input attenuator setting is different between two channels and the dual channel is turn on, or continuous trigger mode is selected after full 2-port calibration is performed when 4395A is used with the S-parameter test set. To avoid premature wearing out of the output power switch, input attenuator switch, or internal switch of the S-parameter test set, change trigger type to HOLD, SINGLE, or NUMBER of GROUP to hold sweep after measurement required. Or, for example, turn off the dual channel, or set the power level and the input attenuator of both channels to the same setting.

### 54 TOO MUCH DATA

Either there is too much binary data to send to the analyzer when the data transfer format is FORM 2, FORM 3 or FORM 5, or the amount of data is greater than the number of points.

### 55 NOT ENOUGH DATA

The amount of data sent to the analyzer is less than that expected (*GPIB only*).

### 56 OPTION NOT INSTALLED

This error occurs when an GPIB command which is optional command is sent and the analyzer is not installed the option (*GPIB only*). Please confirm options installed to the analyzer using \*OPT? command (see *Programming Manual*.)

### 64 TOO MANY SEGMENTS

The maximum number of segments for the limit line table is 18.

### 74 CURRENT EDITING SEGMENT SCRATCHED

The current editing segment for the list table and the limit line is scratched when the following cases occur (*GPIB only*) :

- When EDITLIST (edit list table) command is received while editing a segment for the list table.
- When EDITLIML (edit limit line) command is received while editing a segment for the limit line.

Send LIMSDON (limit segment done) or SDON (segment done) to terminate editing segment.

### 75 COMMAND IGNORED - SEGMENT NOT DONE YET

The GPIB command the analyzer received is ignored, because the segment is editing (*GPIB only*). Send LIMSDON (limit segment done) or SDON (segment done) to terminate editing segment. (See *Programming Manual*.)

### 76 SEGMENT START/STOP OVERLAPPED

Segments are not allowed to be overlapped. Reenter appropriate value for start or stop value of segments to avoid that segment is not overlapped.

**77 TOO MANY SEGMENTS OR POINTS**

Frequency list mode is limited to 31 segments or 801 points.

**78 TOO SMALL POINTS OR TOO LARGE STOP**

STOP+SPAN/(NOP-1) is out of sweep range. Increase NOP or change STOP value to lower frequency to avoid this error.

**82 CAN'T CHANGE- ANOTHER CONTROLLER ON BUS**

The analyzer cannot assume the mode of system controller until the active controller is removed from the bus or relinquishes the bus. See *Programming Manual*.

**83 FORMAT NOT VALID FOR MEASUREMENT**

The conversion function except the 1/S and the multiple phase modes is not valid for the Smith, admittance, and SWR formats.

**84 ANALYZER TYPE MISMATCH**

The analyzer receives a command that is not available for the current analyzer type. Please confirm GPIB command or change analyzer type before sending the command.

**93 NO DATA TRACE**

The **MARKER ON [DATA]** is selected when the data trace is not displayed.

**94 NO MEMORY TRACE**

The **MARKER ON [MEMORY]** is selected when the memory trace is not displayed.

**95 NO MARKER DELTA - SPAN NOT SET**

The **MKRΔ→SPAN** softkey requires that delta marker mode be turned ON.

**96 NO MARKER DELTA - RANGE NOT SET**

The **MKRΔ→SEARCH RNG** softkey requires that delta marker is turned ON.

**97 CAN'T CHANGE WHILE DATA MATH ON**

The setting cannot be changed when the data math function is used.

**98 NO ACTIVE MARKER**

The marker→ command cannot be execute when no marker is displayed on the screen. Turn on the marker before executing the marker→ commands.

**99 CAN'T CHANGE WHILE DUAL CHAN OFF**

The Cross channel cannot be turned on when dual channel is off. Turn on the dual channel before the cross channel is turned on.

## **Error Messages in Numerical Order**

### **100 NO FIXED DELTA MARKER**

The **FIXED ΔMKR VALUE** and **FIXED ΔMKR AUX VALUE** softkey requires that fixed delta marker is turned ON.

## **101 - 200**

### **110 SAVE ERROR**

A serious error, for example physically damaged disk surface, is detected on saving a file.

### **111 RECALL ERROR: INSTR STATE PRESET**

A serious error, for example corrupted data, is detected on recalling a file, and this forced the analyzer to be PRESET.

### **112 INVALID FILE NAME**

*GPIB only.* The file name for the RECALL, PURGE, or RE-SAVE function must have a “\_D” or “\_S” extension for LIF format.

### **113 NO STATE/DATA FILES ON DISK**

There are no files on the flexible disk with extensions, “\_D” or “\_S” for LIF format, or “STA” or “.DTA” for DOS format.

### **114 CAN'T SAVE GRAPHICS WHEN COPY IN PROGRESS**

If you attempt to save graphics when a print is in progress, this error message is displayed.

### **115 LIF-DOS COPY NOT ALLOWED**

If you try to copy a file between the memory disk and the flexible disk when the format of the memory disk is different from the format of the flexible disk, this message is displayed.

### **116 NO STATE/DATA FILES ON MEMORY**

There are no files on the memory disk with extensions, “\_D” or “\_S” for LIF format, or “.STA” or “.DTA” for DOS format.

### **117 DUPLICATE FILE EXTENSION**

The extension name entered is already used for other file types. Use other extension name.

### **119 NO DATA TRACE DISPLAYED**

The **SCALE FOR [DATA]** is selected when the data trace is not displayed.

### **120 NO MEMORY TRACE DISPLAYED**

The **SCALE FOR [MEMORY]** is selected when the memory trace is not displayed.



**124 LIST TABLE EMPTY OR INSUFFICIENT TABLE**

The frequency list is empty. To implement the list frequency mode, add segments to the list table.

**126 CAN'T CHANGE NUMBER OF POINTS**

The number of points of the spectrum analyzer mode cannot be to change manually, except in zero span.

**127 CAN'T SET SWEEP TIME AUTO IN ZERO SPAN**

The automatic sweep time cannot be in zero span of the spectrum analyzer mode. (The network analyzer mode allows that the automatic sweep time is turned on.)

**128 SPAN = 0 ONLY**

The setup must be zero span and spectrum analyzer mode when turning on the RF OUTPUT.

**131 FREQUENCY SWEEP ONLY**

The sweep type must be frequency sweep when the center step size is set.

**133 CAN'T CHANGE ON LIST SWEEP**

When list sweep is selected, the following parameters are not allowed to be changed:

- CENTER, SPAN, START, STOP
- NOP
- IFBW or RBW
- POWER
- DC SOURCE

Modify the list table to change these parameters in the list sweep.

**134 CAN'T COUPLE IN CURRENT INPUTS**

When one channel measures a ratio measurement, and the other one measures an absolute measurement (for example: A/R and B), **COUPLED CH** can not be turned on.

**135 COUPLED CHAN - BETWEEN NA&NA OR ZA&ZA**

The analyzer types of both channels must be the network analyzer mode or impedance analyzer mode when the coupled channel is turned on. It is not possible to turn the coupled channel on in spectrum analyzer mode.

**136 DC SOURCE OVERLOAD**

The DC SOURCE output is overloaded.

## **Error Messages in Numerical Order**

### **137 DC CURRENT LIMIT OCCURED**

The output current at DC SOURCE port is reached to an upper limit and the output voltage is reduced so that the current does not exceed the upper limit. This message appears when the DC SOURCE port is used in voltage control mode.

### **138 DC VOLTAGE LIMIT OCCURED**

The output voltage at DC SOURCE port is reached to an upper limit and the output current is reduced so that the voltage does not exceed the upper limit. This message appears when the DC SOURCE port is used in current control mode.

### **141 INSUFFICIENT MEMORY**

If a lot of tasks is executed at same time, memory might be insufficient for a while. (For example, running HP Instrument BASIC program, printing a screen, and sending or receiving data array by GPIB are required at same time.) Please wait until finishing some tasks then execute the next task.

### **143 FLOATING POINT ERROR OCCURED**

Indicate that a floating point error occurred in the analyzer. Data processing may not be correct. This error message is used when an internal application was executed for illegal data sent from an external device, or when an internal software bug was detected. Contact your nearest Agilent Technologies office.

### **146 ON POINT NOT ALLOWD FOR THE CURRENT TRIG**

The trigger event mode cannot be changed to the ON POINT mode because the current trigger source setting does not allow the ON POINT mode. The ON POINT mode is available for only MANUAL, EXTERNAL, and BUS trigger sources of the network analyzer mode.

### **154 INVALID DATE**

The date entered to set the real time clock is invalid. Reenter correct date.

### **184 NOT ALLOWED IN SVC MODE**

The operation is not allowed in service mode.

### **193 POWER ON TEST FAILED**

Power on test failed. Contact your nearest Agilent Technologies office.

## **201 - 300**

### **267 COMPENSTATION REQUIRED**

Compensation is required. Perform compansation to obtain compensation data.

**268 NO COMPENSATION CURRENTLY IN PROGRESS**

No compensation is currently in progress.

**269 COMPENSATION ABORTED**

Compensation data acquisition process is aborted.

**270 COMPENSATION STD LIST UNDEFINED**

Compensation standard list is undefined.

**– 1 - – 100**

**–100 Command error**

This is a generic syntax error that the analyzer cannot detect more specific errors. This code indicates only that a command error, as defined in IEEE 488.2, 11.5.1.1.4, has occurred.

**– 101 - – 200**

**–101 Invalid character**

A syntax element contains a character that is invalid for that type. For example, a header containing an ampersand (SENSE&).

**–102 Syntax error**

An unrecognized command or data type was encountered. For example, a string was received when the analyzer was not expecting to receive a string.

**–103 Invalid separator**

The parser was expecting a separator and encountered an illegal character. For example, the semicolon was omitted after a program message unit, \*RST:TRIG.

**–104 Data type error**

The parser recognized an unallowed data element. For example, numeric or string data was expected but block data was encountered.

**–105 GET not allowed**

A Group Execute Trigger (GET) was received within a program message (see IEEE 488.2, 7.7).

**–108 Parameter not allowed**

More parameters were received than expected for the header. For example, the \*SRE command only accepts one parameter, so receiving \*SRE 4,16 is not allowed.

## **Error Messages in Numerical Order**

### **–109 Missing parameter**

Fewer parameters were received than required for the header. For example, the **\*SRE** command requires one parameter, so receiving only **\*SRE** is not allowed.

### **–110 Command header error**

An error was detected in the header. This error message is used when the analyzer cannot detect the more specific errors described for errors –111 through –119.

### **–111 Header separator error**

A character that is not a legal header separator was encountered while parsing the header. For example, no white space followed the header, thus **\*SRE4** is an error.

### **–112 Program mnemonic too long**

The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).

### **–113 Undefined header**

The header is syntactically correct, but it is undefined for the analyzer. For example, **\*XYZ** is not defined for the analyzer.

### **–114 Header Suffix out of range**

The value of a numeric suffix attached to a program mnemonic makes the header invalid.

### **–120 Numeric data error**

This error, as well as errors –121 through –129, are generated when parsing a data element that appears to be numeric, including the nondecimal numeric types. This particular error message is used if the analyzer cannot detect a more specific error.

### **–121 Invalid character in number**

An invalid character for the data type being parsed was encountered. For example, an alpha character in a decimal numeric or a “9” in octal data.

### **–123 Exponent too large**

The magnitude of the exponent was larger than 32000 (see IEEE 488.2, 7.7.2.4.1).

### **–124 Too many digits**

The mantissa of a decimal numeric data element contains more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

### **–128 Numeric data not allowed**

A legal numeric data element was received, but the analyzer does not accept it in this position for a header.

### –130    **Suffix error**

This error, as well as errors –131 through –139, are generated when parsing a suffix. This particular error message is used if the analyzer cannot detect a more specific error.

### –131    **Invalid suffix**

The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for the analyzer.

### –134    **Suffix too long**

The suffix contained more than 12 characters (see IEEE 488.2, 7.7.3.4).

### –138    **Suffix not allowed**

A suffix was encountered after a numeric element that does not allow suffixes.

### –140    **Character data error**

This error, as well as errors –141 through –148, are generated when analyzing the syntax of a character data element. This particular error message is used if the analyzer cannot detect a more specific error.

### –141    **Invalid character data**

Either the character data element contains an invalid character or the particular element received is not valid for the header.

### –144    **Character data too long**

The character data element contains more than twelve characters (see IEEE 488.2, 7.7.1.4).

### –148    **Character data not allowed**

A legal character data element was encountered where prohibited by the analyzer.

### –150    **String data error**

This error, as well as errors –151 and –158, are generated when analyzing the syntax of a string data element. This particular error message is used if the analyzer cannot detect a more specific error.

### –151    **Invalid string data**

A string data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.5.2). For example, an END message was received before the terminal quote character.

### –158    **String data not allowed**

A string data element was encountered but was not allowed by the analyzer at this point in parsing.

## **Error Messages in Numerical Order**

### **–160 Block data error**

This error, as well as errors –161 and –168, are generated when analyzing the syntax of a block data element. This particular error message is used if the analyzer cannot detect a more specific error.

### **–161 Invalid block data**

A block data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.6.2). For example, an **END** message was received before the length was satisfied.

### **–168 Block data not allowed**

A legal block data element was encountered but was not allowed by the analyzer at this point in parsing.

### **–200 Execution error**

This is the generic syntax error that the analyzer cannot detect more specific errors. This code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.

## **–201 - –300**

### **–210 Trigger error**

A trigger related error occurred. This error message is used when the analyzer cannot detect the more specific errors described for errors –211 through –219.

### **–211 Trigger ignored**

A GET, \*TRG, or triggering signal was received and recognized by the analyzer but was ignored because of analyzer timing considerations. For example, the analyzer was not ready to respond.

### **–213 Init ignored**

A request for a measurement initiation was ignored as another measurement was already in progress.

### **–220 Parameter error**

Indicates that a program data element related error occurred. This error message is used when the analyzer cannot detect the more specific errors described for errors –221 through –229.

### **–221 Settings conflict**

A legal program data element was parsed but could not be executed due to the current device state (see IEEE 488.2, 6.4.5.3 and 11.5.1.1.5).

### –222    **Data out of range**

A legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the analyzer (see IEEE 488.2, 11.5.1.1.5).

### –223    **Too much data**

A legal program data element of block, expression, or string type was received that contained more data than the analyzer could handle due to memory or related device-specific requirements.

### –224    **Illegal parameter value**

Used where exact value, from a list of possibilities, was expected.

### –225    **Data out of memory**

The analyzer has insufficient memory to perform the requested operation.

### –230    **Data corrupt or stale**

Possibly invalid data. New reading started but not completed since last access.

### –231    **Data questionable**

Indicates that measurement accuracy is suspect.

### –240    **Hardware error**

Indicates that a legal program command or query could not be executed because of a hardware problem in the analyzer. Definition of what constitutes a hardware problem is completely device-specific. This error message is used when the analyzer cannot detect the more specific errors described for errors –241 through –249.

### –241    **Hardware missing**

A legal program command or query could not be executed because of missing analyzer hardware. For example, an option was not installed.

### –250    **Mass storage error**

Indicates that a mass storage error occurred. This error message is used when the analyzer cannot detect the more specific errors described for errors –251 through –257.

### –256    **File name not found**

A legal program command could not be executed because the file name on the device media was not found: for example, an attempt was made to read or copy a nonexistent file.

### –257    **File name error**

Indicates that a legal program command or query could not be executed because the file name on the device media was in error. For example, an attempt was made to copy to a duplicate file name. The definition of what constitutes a file name error is device-specific.

## Error Messages in Numerical Order

### –280 Program error

Indicates that a downloaded program-related execution error occurred. This error message is used when the analyzer cannot detect the more specific errors described for errors –281 through –289.

### –281 Cannot create program

Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory.

### –282 Illegal program name

The name used to reference a program was invalid. For example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.

### –283 Illegal variable name

An attempt was made to reference a nonexistent variable in a program.

### –284 Program currently running

Certain operations dealing with programs may be illegal while the program is running. For example, deleting a running program might not be possible.

### –285 Program syntax error

Indicates that a syntax error appears in a downloaded program. The syntax used when parsing the downloaded program is device-specific.

### –286 Program runtime error

A program runtime error of the HP Instrument BASIC has occurred. To get a more specific error information, use the **ERRM\$** or **ERRN** command of the HP Instrument BASIC.

## –301 - –400

### –310 System error

Some error, termed “system error” by the analyzer, has occurred.

### –311 Memory error

An error was detected in the analyzer’s memory.

### –330 Self-test failed

A self-test failed. Contact your nearest Agilent Technologies office or see the *Service Manual* for troubleshooting.



**–350 Queue overflow**

A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.

**–400 Query errors**

This is the generic query error that the analyzer cannot detect more specific errors. This code indicates only that a query error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.

**–401 - –500**

**–410 Query INTERRUPTED**

A condition causing an interrupted query error occurred (see IEEE 488.2, 6.3.2.3). For example, a query followed by DAB or GET before a response was completely sent.

**–420 Query UNTERMINATED**

A condition causing an unterminated query error occurred (see IEEE 488.2, 6.3.2.2). For example, the analyzer was addressed to talk and an incomplete program message was received by the controller.



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### **Latin America:**

Agilent Technologies  
Latin American Region Headquarters  
5200 Blue Lagoon Drive, Suite #950  
Miami, Florida 33126  
U.S.A.  
(tel) (305) 267 4245  
(fax) (305) 267 4286

### **Australia/New Zealand:**

Agilent Technologies Australia Pty Ltd  
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(tel) 1-800 629 485 (Australia)